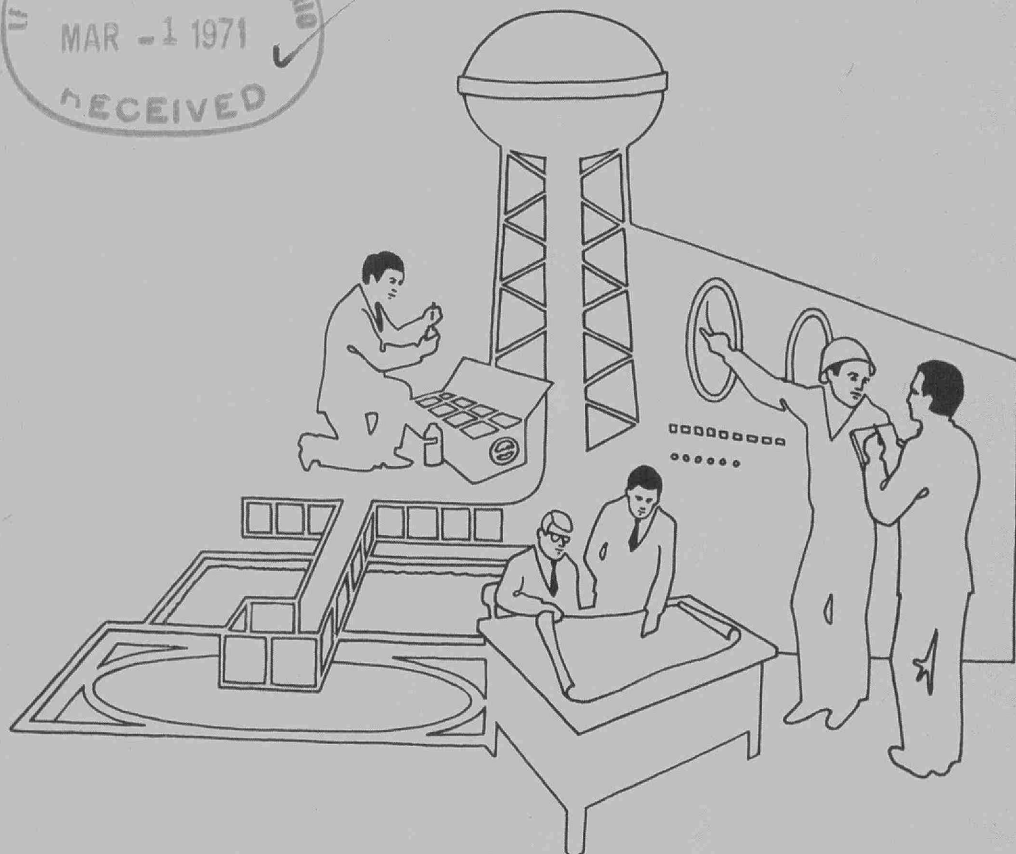
Water management in Ontario

Ontario
Water Resources
Commission

District
Engineers
Branch

O.W.R.C.
Water Pollution
Survey





# WATER POLLUTION SURVEY

## of the

## CITY OF OSHAWA

1970

THE

ONTARIO WATER RESOURCES

COMMISSION

Report on a

Water Pollution Survey

of the

City of Oshawa

Division of Sanitary Engineering

District Engineers Branch

December, 1970

## City of Oshawa

## Water Pollution Survey Report

INDEX

# Water Pollution Survey

# of the

# City of Oshawa

## INTRODUCTION

During May 1970, a water pollution survey was made in the City of Oshawa by Commission staff. The purpose of the survey was to review the water quality of the drainage courses in the Oshawa area and to locate potential and existing sources of pollution which could adversely affect the ground and surface water quality.

In 1958, an initial survey was undertaken in the Oshawa area. A subsequent survey was carried out in 1963, to re-assess the water quality and to note any changes. The latest survey re-sampled many of the locations covered in the initial and subsequent survey but a more concentrated effort was made to check the water quality of storm sewer effluents.

Bacteriological and chemical samples were collected from pertinent points in the city. All samples collected were submitted to the OWRC Laboratory in Toronto for examination and analysis. The samples obtained were grab samples and only reflect the conditions at the time of sampling. The results of the laboratory tests performed on the samples submitted have been included in the appendices, along with an interpretation of the chemical analysis and bacteriological examination.

A section has also been included on methods of implementing water and sewage works programmes.

The laboratory results from the first and second survey reports have been appended to this report so a comparison can be made by anyone wishing to review the relative change in the stream water quality. Comments have been restricted to assessing the conditions reflected by the latest sample results and where applicable general comparisons were made with previous survey results.

Interviews were conducted with various officials of the City of Oshawa and their co-operation was very much appreciated.

## CITY OF OSHAWA

### General

The City of Oshawa is located on the north shore of Lake Ontario, 32 miles east of the City of Toronto, the Provincial Capital.

The City of Oshawa has a population at the present time of approximately 85,000. The city boundaries, enclosing an area of approximately 22 square miles, have not changed since the time of the initial survey.

Manufacturing industries supply a major portion of the labour force with jobs. The City of Oshawa has a variety of manufacturing industries but the General Motors Corporation Limited predominates the employment picture, employing approximately 21,000 persons.

The City of Oshawa supplies water and sewage services to most of the developed area of the city. The municipal water supply is obtained from Lake Ontario, at a point west of the harbour area. The Oshawa Water Pollution Control Plant utilizes trickling filters to treat the raw sewage received. The effluent from this plant is discharged to Harmony Creek at a point approximately one mile north of the Creek's point of discharge into Lake Ontario.

## SURFACE WATERS

The Oshawa Creek system and the Harmony Creek system are not being used extensively for recreational purposes. There is some fishing in the headwaters but the use of these streams for swimming and other recreational activities is not prevalent. There are some areas along Oshawa Creek which have been dammed up by youngsters to make suitable swimming areas.

### Oshawa Creek

The headwaters of Oshawa Creek originate in the vicinity of the Community of Raglan, approximately 6 miles north of the city limits. A major branch, East Oshawa Creek, begins near Mount Carmel and joins the main branch just inside the city limits above Taunton Road. A smaller tributary known as Goodman Creek joins the main branch just north of the Canadian Pacific right-of-way, east of Park Road. In the area of the harbour,

the St. Julian Drain joins Oshawa Creek. The exact source of the St. Julian Drain is not known because north of Bloor Street, the drain is covered and drainage from an extensive system of storm sewers is collected by this drain. The Oshawa Creek system drains an estimated 30,000 acres of land.

### Harmony Creek

The Harmony Creek system is composed of a number of small tributaries which originate within the immediate area of the city. The main branch of Harmony Creek originates west of Mitchell Corners in the fifth concession of Darlington Township. The largest of the tributaries is Farewell Creek which originates just north of the Community of Solina in Darlington Township. Farewell Creek joins the main branch of Harmony Creek just north of Wentworth Street East.

The Dean Avenue Drain is a tributary of Harmony and very similar to the St. Julian Drain. The open section of the Dean Avenue Drain begins just east of Tennyson Avenue and it joins the main branch of Harmony Creek south of Highway 401. The Harmony Creek watershed includes a total drainage area of approximately 25,000 acres.

## POLLUTION SURVEY RESULTS

### General

A summary of all the samples collected during the survey have been tabulated and organized into a set of tables

which have been included in the appendix at the back of the report.

In the following pages the results of the survey are interpreted and specific problem areas are pinpointed. Area maps of each watercourse have been prepared to help locate the specific sampling points. These maps are contained in the appendix along with a key map of the city.

Oshawa Creek

Stream samples were collected from 21 locations throughout the length of Oshawa Creek. At the same time 50 outfalls were located and examined as possible sources of contamination.

Conditions throughout the length of the creek have improved generally but in certain instances problems are still evident.

There is considerable deterioration in the water quality of Oshawa Creek as it flows through the city. The problem areas on the creek occur at King Street and Bond Street and between Bloor Street and Wentworth Street.

Outfalls

The following list of outfalls all contained waste material of either sanitary origin or from industrial waste processes. The following sampling points are indicated on the maps of Oshawa Creek which have been numbered 1 to 7.

0-1.2W

This municipal storm sewer is located opposite the east end of Scugog Avenue. The bacterial sample results were excessive and suggests that sanitary wastes were present in this outfall.

0-1.7W(E)

There are two storm sewers at Wentworth Street but there was only flow in the storm sewer which drains to the east side of Oshawa Creek. The sample results indicate that sanitary wastes maybe gaining access to this storm sewer. The BOD of the effluent was slightly higher than expected and the bacterial results show excessive bacterial values.

0-1.81(A) and 0-1.81(B)

These two outfalls are private outfalls which carry waste waters from the Robson Lang Leathers. Industrial wastes such as chromium and ether solubles were very high.

Excessively high BOD and coliform bacteria count were also indicated.

0-2.2W

This outfall is a municipal storm sewer. An ex-

cessive concentration of chromium was found to be in the effluent from this storm sewer.

0-2.4W

This storm sewer drains to an open ditch on the west side of Oshawa Creek near the corner of Malaga Road and Glen Street. The samples results show excessive coliform bacteria present.

0-2.6W(E) and 0-2.6W(W)

These two storm sewers are located at Bloor Street. The sample results indicate an excessive level of coliform bacteria in the effluent.

0-3.54W

This storm sewer outfall discharges to the east side of Oshawa Creek adjacent to the west end of Lloyd Street. The results indicate the presence of coliform bacteria in excessive numbers.

0-3.6 W(E)

This storm sewer outfall discharges to the west side of Oshawa Creek just south of the John Street Bridge. The effluent BOD was higher than might be expected and the bacteriological results indicated an excessive number of coliform bacteria.

<u>0-4.0W(E)</u>

This storm sewer outfall is located at Bond Street West and the effluent is discharged to the east side of Oshawa Creek. The sample results indicate the presence of both industrial and sanitary wastes. Small amount of Chromium and zinc were present in the effluent and a highly unsatisfactory concentration of lead was also found.

<u>0-4.03I</u>

This is a private outfall located just north of Bond Street West which carries wash water from the Auto-Magic Car Wash to the east side of Oshawa Creek. The effluent contained a very high BOD and the numbers of coliform bacteria were excessive.

<u>0-4.1W</u>

This storm sewer is located at the west end of William Street. The bacteriological report indicates excessive numbers of coliform bacteria in the effluent.

<u>0-4.55W</u>

This storm sewer is located adjacent to Ridgeway Avenue. The effluent from this storm sewer flows through an open ditch to the west side of Oshawa Creek. The high count of coliform bacteria indicates the presence of sanitary wastes.

0-4.6W

This storm sewer outfall is located at the west end of Alexandra Street. The effluent from this storm sewer contained excessive numbers of coliform bacteria.

0-5.5W(E)

This storm sewer outfall is located on the east side of Oshawa Creek at Rossland Road. The bacteriological sample results indicate excessive numbers of coliform bacteria.

The above sampling points are the locations where the most serious problems were noted.

Goodman Creek

Goodman Creek is a branch of Oshawa Creek which drains the western edge of the City of Oshawa. During the survey samples were collected from the creek at 10 different locations. An examination was made of 21 outfalls throughout the length of the creek. The locations of the outfalls are shown on the maps of Goodman Creek which have been appended to this report.

The sample results show unsatisfactory conditions in the northern section of this creek. There are no apparent outfalls in this area which can account for the results, and development is very scattered.

Between Rossland Road and Highway #2 the water quality was very good and there was no major source of contamination reaching the creek. Below Highway #2 gradual deterioration in the stream quality takes place. Here, the adverse effect of discharges to the creek is significant and there is no improvement in the stream quality throughout the remainder of the creek until dilution with Oshawa Creek takes place. No apparent improvement has taken place over the past 12 years.

Outfalls

The following list of outfalls had unsatisfactory effluents.

OG-3.6W

This storm sewer outfall is located at the south end of Montrave Avenue. The analysis of the samples collected at this sampling point were not particularly unsatisfactory but the visual appearance of this outfall suggested that inadequately treated wastes have been or are discharged at this location from time to time.

OG-3.8W

This storm sewer outfall is located just west of Grenfell Street and the effluent is discharged to the north side of Goodman Creek. The BOD of the effluent is not excessive but the BOD level is higher than would be expected.

OG-4.7W(E)

This storm sewer outfall is located at Highway #2. The effluent is discharged to the east side of the creek. The bacteriological report indicates excessive numbers of coliform bacteria.

St. Julian Drain

The St. Julian Drain collects storm water and wastes from a large portion of the central section of the city. For the most part the drain is covered and it is only south of Bloor Street that the drain becomes an open watercourse. During the past years there has been a definite improvement in the water quality of this drainage course, but there continues to be evidence of the presence of industrial and sanitary wastes.

Four stream samples were collected from the open section of the drainage course. The sampling locations are shown on the appended drawing titled "St. Julian Drain".

The condition of the drainage course is very poor. Some improvement can be seen in the stream quality as it approaches the harbour area.

Outfalls

An examination was made of five storm sewer outfalls on the St. Julian Drain. The storm sewer outfall at Waterloo Street had no flow at the time of the survey.

OS-1.1W

This municipal storm sewer is located at Wentworth Street. An excessive amount of solids was evident in the effluent but in other respects the results were generally satisfactory.

OS-1.3W

The municipal storm sewer adjacent to the east end of Conant Street contained evidence of sanitary wastes. The bacteriological report indicated a high total and fecal coliform counts.

OS-1.5W(E) and OS-1.5W(W)

There are two storm sewer outfalls at Bloor Street. Both outfalls show some evidence of sanitary wastes. The bacterial results are high in the east side outfall and in the west side outfall the BOD is quite high and bacterial results are excessive. The presence of industrial-type wastes are indicated in the west outfall. The concentration of zinc and ether solubles are excessive.

Harmony Creek System

During the survey of the Harmony Creek system, 36 stream samples were collected and 61 outfalls were examined. The sampling locations are shown on the drawings of the Harmony Creek system which are appended.

The results of the sampling programme indicate that the water quality of Harmony Creek and tributaries was generally very good. There appears to be a few problems but these are very localized.

Harmony Creek (Main Branch)

The stream water quality of the Main Branch of Harmony Creek was very good. The problems first noted in the 1958 survey report have been corrected for the most part. There were only two problems on the main branch. A total of 8 stream samples were collected and 18 outfalls were examined in this section.

Outfalls

H-0.9T

This outfall is the municipal sewage treatment plant effluent pipe. The sample results indicate an effluent with a high BOD, a high suspended solids concentration, an excessive number of coliform bacteria.

H-4.6W

This outfall is a municipal storm sewer which is located opposite the Oshawa Missionary College north of King Street East. The effluent from this storm sewer had a high BOD.

Dean Avenue Drain

The Dean Avenue Drain collects storm water from as far north as Wilson Road and Bond Street East. Most of the drain is covered and it is only in the south end that the drain is open. In the initial survey report, there was some evidence of industrial type wastes in this drain. In the 1963 survey report, the problem was not apparent but there was some indication that sanitary wastes were present. The most recent sample results suggest that sanitary wastes are gaining access to this storm sewer.

Outfalls

HD-2.30W(E)

This storm sewer outfall is located at Kingside Park and the effluent is discharged to the north side of the Dean Avenue Drain. Excessive numbers of coliform bacteria were detected in the samples collected.

HD-2.30W(W)

This storm sewer outfall is located on the east side of Tennyson Avenue. This outfall marks the end of the closed portion of the Dean Avenue Drain. The bacterial results indicates excessive numbers of coliform bacteria in the effluent.

Farewell Creek

Farewell Creek only drains a small portion of the City of Oshawa. There is relatively little development in this area.

There was only one outfall draining to the creek and there was no apparent problem.

Harmony Creek (West Branch)

During the survey, eight stream samples were collected from the west branch of Harmony Creek and elèven outfalls were examined. The laboratory results from these samples indicated that the water quality was generally satisfactory. The previous surveys also indicate good water quality.

Harmony Creek (North West Branch)

During the previous surveys there have been some problems in the very north end of this branch. But apparently, the problems have been corrected. There were 27 outfalls examined during the survey and 17 stream samples were collected. There was only one location where the sample results suggest that problems may exist.

Outfall

HWO-5.23W

This storm sewer outfall is located just east of Central Park Boulevard North and north of Volendam Avenue. The bacterial sample results indicate excessive numbers of coliform bacteria in this outfall.

HWO-5.6W

This storm sewer outfall is located at Rossland Road East, west of Wilson Road North. This outfall was not sampled during the month of May when most of the samples were collected because it was not accessible. During November a sample was collected and the BOD was excessive.

Pollution Control

Municipal

The City of Oshawa is served by a municipal sewage treatment and collection system. The sewage treatment plant was constructed in 1955. The present design capacity of existing facilities is 9.0 US MGD. During 1969 the average day flow was 8.1 US MGD. Since the average day flows to the plant are nearing capacity, expansion of the plant has been recommended and the municipality has retained a consultant to do the necessary design. The proposed works include the elimination of the effluent discharge to Harmony Creek by the construction of an outfall pipe to Lake Ontario. Bacterial samples collected at the time of the survey indicated excessive numbers of coliform bacteria in the plant effluent. This was due to problems with disinfection of the effluent. A special study made recently by our Division of Research revealed that the problem is due to inefficiency of the existing chlorination pond in providing disinfection. The proposed new works will include improved chlorination facilities for the plant effluent.

Joint planning by the City of Oshawa and the Town of Whitby will see the construction of a sewage treatment plant at the mouth of Corbett Creek. This will serve the adjoining areas of these two municipalities.

Over the past few years, the City of Oshawa has instituted a correction programme to determine sources of contamination of the storm sewer system and subsequent diversion of these flows to the sanitary sewer system. A number of problems have been corrected on Oshawa Creek.

The municipal sanitary landfill site located in the northern section of the creek's watershed, was responsible for a number of complaints a few years ago. Surface drainage from the site was adversely affecting the stream quality. Steps were taken to prevent runoff to the nearby creek and at present two pumping stations are located on the site and runoff is collected and pumped to the sanitary sewer system.

The City of Oshawa officials initiated a programme whereby the industrial waste loading from each industry to the sewerage system is monitored to protect the sewer system and to prevent an adverse effect on the operation of the municipal sewage treatment plant.

Industrial

Through co-operation of the local industries with the City of Oshawa and the OWRC, solutions to industrial wastes problems are being developed.

The Robson-Lang Leathers has had the most difficulty in solving their waste disposal problem. The volume and type of wastes from the industry has had a very detrimental effect on the water quality of Oshawa Creek. Robson Lang Leathers has screening, settling, chemical and pH control facilities. At the present time 10% of the waste is being discharged to the sanitary sewers. A sampling programme has been established to determine whether the present treatment reduces the waste to a strength acceptable for discharge to the sanitary sewer system.

In the section of the report which lists the outfalls containing unsatisfactory effluents, the Whiting Avenue Storm Sewer was mentioned. A high concentration of chromium was detected in the effluent sample. The Houdaille Industries Limited has been found to be responsible. In addition to the chromium type wastes present in this storm sewer, a nickel type waste was also being discharged to this sewer. The company has taken steps to reclaim the plating wastes so as to meet the OWRC objectives. Through a sampling programme, the need for further treatment such as neutralization and solids removal will be determined.

A major source of ether solubles and phenols in the St. Julian Drain has been attributed to Duplate Canada Limited. It has been reported that changes in production have been made which will eliminate the oil wastes. A phenol-free coolant is to be used in the glass edging operation and this should reduce the phenol waste problem. Our Division of Industrial Wastes has directed Duplate Canada Limited to stop discharging their coolant to the storm sewer.

A private outfall (0-4.03I) to Oshawa Creek just north of Bond Street belongs to the Auto-Magic Car Wash. The samples collected during the survey showed the effluent from this operation to have a very high BOD, suspended solids concentration and excessive numbers of coliform bacteria. This information has been made known to the owner of the car wash. The problem has been discussed in detail with the owner and he has indicated that he will install the required pumping equipment to deliver all wastes to the sanitary sewer system.

## SUMMARY AND CONCLUSIONS

A water pollution survey was made of the City of Oshawa during the month of May. This is the third survey report by the Division of Sanitary Engineering. An attempt was made at this time to examine all of the storm sewer outfalls to determine whether any of these discharged waste waters unsuitable for discharge to surface waters.

There has been a general improvement in the stream quality during the past years, but there still exists a number of problems.

There are a number of storm sewers along Oshawa Creek carrying industrial and sanitary wastes. Locating the sources of contamination to the storm sewers will require extensive sampling of the internal storm sewer collection system by the municipality. The most outstanding problem continues to be the effect of waste discharges from Robson Lang Leathers, but efforts by those parties concerned should hopefully be rewarded sometime in the new year. It is anticipated that the new pre-treatment facilities will effectively reduce the strength of the wastes so that discharge to the sanitary sewer system will be permissible.

Good progress has been made in locating and correcting sources of contamination in the St. Julian Drain. Further improvement in the water quality of the drain is expected as additional corrections are made.

Further investigations should be made along Goodman Creek to determine the sources of contamination which are adversely affecting the stream water quality. This will be done by staff during 1971.

The Harmony Creek system has very few problems. The disinfection problem at the sewage treatment plant is probably having the greatest effect on Harmony Creek. The construction

of proposed new facilities should correct this problem.

The municipality has an active programme of pollution abatement, however, much additional work is needed to correct the outstanding problems outlined in this report.

RECOMMENDATIONS

The present pollution control programme should be continued and expanded in order to locate and to prevent all sources of untreated and/or inadequately treated wastes from reaching the watercourses.

/jkc

Prepared by: J. A. Clarke

J. A. Clarke,
Technologist,
Division of Sanitary Engineering.

# APPENDIX I

## City of Oshawa

## Water Pollution Survey

## 1970

## Water Quality and Effluent Objectives

N.B. A pamphlet entitled

"Guidelines and Criteria

for

Water Quality Management

in

Ontario" has been enclosed

in the map pocket at the back of the report

## APPENDIX I

## WATER QUALITY AND EFFLUENT OBJECTIVES

The OWRC objectives for surface waters is described in a booklet entitled "Guidelines and Criteria for Water Quality Management in Ontario". A copy of the booklet is enclosed in the pocket on the back cover of this report. This publication contains the guidelines and introduces water quality criteria for various uses including public, agricultural and industrial water supply, recreation, aesthetic enjoyment and the propagation of fish and wildlife. The guidelines should be followed to determine the acceptability of a watercourse for various uses.

A few pertinent maximum limits of contaminants in sewage treatment plant and industrial effluents are listed below. Adequate protection for surface waters except in certain specific instances influenced by local conditions, should be provided if the following concentrations and pH range are not exceeded in such effluents.

5-Day BOD - not greater than 15 ppm
Suspended Solids - not greater than 15 ppm
Phenols - not greater than 20 ppb
pH - 5.5 to 10.6
Iron - not greater than 17 ppm
Ether solubles (Oil) - not greater than 15 ppm

## GLOSSARY OF TERMS

Bacteriological Examinations - The Membrane Filter Technique is used to obtain a direct count of coliform organisms. These

organisms are the normal inhabitants of the intestines of man and other warm-blooded animals and soils. They are always present in large numbers in untreated sewage and are, in general, relatively few in number in other stream pollutants. The fecal portion of the total coliforms originate only in the intestines of man and warm-blooded animals and indicate recent pollution.

Biochemical Oxygen Demand (BOD) - The biochemical oxygen demand test indicates the amount of oxygen required for stabilization of the decomposable organic matter found in sewage, sewage effluent, polluted waters, or industrial wastes, by aerobic biochemical action.

Solids - The analyses for solids include tests for total, suspended and dissolved solids. The total solids is a measure of the solids in solution and in suspension. Suspended solids indicate the measure of undissolved solids of organic or inorganic nature whereas the dissolved solids are a measure of those solids in solution.

Oils and Ether Solubles Materials - These include oils and all other solubles materials such as tarry substances and greases. The presence of these pollutants renders water difficult and sometimes impractical to treat either for industrial or domestic use. Oils make streams unsightly and water unfit for bathing.

Phenolic Compounds - The presence of phenol or phenolic equivalents is generally associated with discharges containing petroleum products, or with wastes from some industries. It

is generally conceded that adequate protection of surface waters will be provided if the concentration of phenols in waste discharges does not exceed 20 parts per billion (ppb). Phenolic type waste can cause objectionable conditions in water supplies and might taint the flesh of fish.

Iron - Water for domestic use should contain less than 0.3 parts per million of iron in order to avoid objectionable tastes, staining and sediment formation. Iron concentrations of not greater than 17 parts per million in waste discharges should permit adequate protection of surface waters.

Chromium - The maximum permissible concentration of hexavalent chromium ($Cr^{+6}$) for water supplies is 0.05 ppm. Chromium may occur in this form in waste waters from the manufacture of chromates; in chromium plating wastes and as trivalent chromium in chrome tanning liquor. Trivalent chromium ($Cr^{+3}$) and hexavalent chromium ($Cr^{+6}$) may exist in water supplies, although the trivalent form rarely occurs in potable water supplies since it precipitates as hydroxide in a neutral or alkaline medium.

Zinc - The allowable zinc level in a water supply is a maximum of 5.0 ppm. In most surface and groundwaters zinc concentrations are present only in trace amounts. Zinc most commonly enters a domestic water supply through waters which have received waste discharges.

Lead - Lead compounds are toxic to all forms of life. They may occur in natural waters or in various industrial and mining effluents. The maximum allowable concentration of lead in potable water is 0.05 ppm.

Cyanide - Cyanides are likely to occur in effluents from gas works and coke ovens, from the scrubbing of gases produced from blast furnaces, in wastes from the surface cleaning of various metals and electroplating processes, and chemical industries. Cyanide in waters is toxic to biological life, the toxicity concentration depending on water quality, temperature and type and size of organism. Fish appear to be greatly affected with values as low as 0.05 ppm being reported toxic to trout. The OWRC Drinking Water Objective is less or equal to 0.01 ppm as $CN^-$.

# APPENDIX II

## City of Oshawa

## Water Pollution Survey

## 1970

## Implementatiion of Water

## and

## Sewage Works

## Programmes

# APPENDIX II

## IMPLEMENTATION OF WATER AND SEWAGE WORKS PROGRAMMES

Currently, there are three general methods which may be utilized for implementing sewage and water works programmes. These are: 1) to enter into an agreement with the OWRC for the construction of the treatment and collector works with an obligation to pay the debt retirement and operating charges over the term of the agreement with the facility reverting to the municipality at the end of the term of the agreement, 2) by requesting the provision of service from a Provincially-owned project, and 3) by proceeding with the construction independently and meeting capital costs by the sale of debentures.

## OWRC/MUNICIPAL PROJECTS

For the construction of water and sewage works under agreement with this Commission, the works are provided and developed under Sections 39 to 46 of the Ontario Resources Commission Act.

For this type of arrangement, the Commission utilizes a sinking fund and consequently the annual payments are based on a specific debt retirement period and the payments are unchanged for the period of the agreement. This type of

project may be financed over a period of time up to a maximum of thirty years. The annual charges for projects constructed under this agreement are determined as follows:

1. Capital Repayment

As noted, OWRC financing is by the sinking fund method and an annual payment of approximately 2 per cent of the capital cost is required to retire a debt over a thirty-year period.

2. Interest

On new Commission projects, interest is calculated at the current rate.

3. Reserve Fund

To provide money for repairs and replacements, Section 40 of the Ontario Water Resources Commission Act provides for the establishment of a reserve fund by the Commission. It is important to note that this fund is established in the name of the municipality and the balance consequently earns interest. It has now been established by Commission minute that the reserve fund billing for each project shall continue only until the fund reaches an amount of ten times the initial annual billing and the reserve fund billing shall be re-imposed only when the fund has been depleted to 80 per cent or less of the maximum amount.

4. Operating Costs

Under OWRC agreement, the municipality is responsible only for the operating costs directly attributed to the project in the municipality. Therefore, no charges are made by the Commission for the services of head office personnel who are available as required to advise on the satisfactory operation and maintenance of the project.

## PROVINCIALLY-OWNED PROJECTS

In June 1967, the Honourable J. R. Simonett, Minister of Energy and Resources Management, made an announcement which expanded the authorization of this Commission for the provision of water supply and sewage treatment facilities. This new program allows the Commission to construct entire water and sewage works facilities for small municipalities. The capital costs of these can be amortized over a 40 year period.

A slight variation of this programme could be implemented in that the municipality may request that this Commission provide only the major water and sewage works facilities as Provincially-owned works, and develop the water distribution and sewage collector systems under the standard type of Commission project. It would appear that where applicable, it would be more advantageous for the municipality to

proceed on the basis of requesting this Commission to develop entire systems as Provincially-owned works.

The associated cost of supplying these works, including amortization of capital costs, together with operating and maintenance charges, will be recovered by the sale of service to the affected municipalities by rates determined on a usage basis. These facilities will be wholly-owned by the Province of Ontario and the arrangements for service will be formalized by contracts between the Commission and the municipality concerned. The installations will be operated entirely at cost with appropriate provision for adjustment in rate.

## DEVELOPMENT

If a municipality, after considering the alternatives, wishes this Commission to consider Provincially-financed projects, application forms should be completed and submitted together with a resolution of the Municipal council. A draft of the suggested wording of the resolution is included with the application forms.

If the proposed works are to be built by the municipality on its own initiative or as a formal project under agreement with this Commission, it is required that the Council retain a consulting engineer to prepare preliminary engineering reports on the proposed work. If a Provincial system is con-

templated, no action should be taken with respect to retaining a consulting engineering firm as the Commission will designate a consulting engineer to carry out the Provincial portion of the work and it would be advantageous if the municipal portion be studied and reported on by the same engineer.

# APPENDIX III

## City of Oshawa

## Water Pollution Survey

## 1970

## Sample Results

1970 - Tables I - IV

1958 and 1963 Tables V - VI

All analyses reported in ppm except where indicated

City of Oshawa

Water Pollution Survey

Table I(a) Oshawa Creek
Samples Collected by:
F. Burford A. McConnell
J. Clarke L. Murray

| Sampling Point No. | Location | Date | BOD | Solids Total | Solids Susp. | Solids Dissolved | Bacteriological Examination Coliform Bacteria per 100 ml Fecal | Bacteriological Examination Coliform Bacteria per 100 ml Total |
|---|---|---|---|---|---|---|---|---|
| 0-0.0 | Oshawa Creek at Harbour Mouth<br>pH at Lab - 7.7<br>Chromium (Cr) - 0.0<br>Zinc (Zn) - 0.01<br>Lead (Pb) - 0.0<br>Cyanide (HCN) - <0.01<br>Ether Solubles - Trace | 19/5/70 | 1.0 | 270 | 10 | 260 | 104 | 300 |
| 0-0.4 | Oshawa Creek at Simcoe Street South<br>pH at Lab - 7.8<br>Chromium (Cr) - 0.07<br>Zinc (Zn) - 0.0<br>Lead (Pb) - 0.0<br>Cyanide (HCN) - <0.01<br>Ether Solubles - Trace | 19/5/70 | 6.0 | 500 | 20 | 480 | 2,000 | 14,000 |
| 0-1.19 | Oshawa Creek Opposite Scugog Avenue Storm Sewer Outfall<br>pH at Lab - 7.9<br>Chromium (Cr) - 0.08<br>Zinc (Zn) - 0.04<br>Lead (Pb) - 0.04<br>Cyanide (HCN) - <0.01<br>Ether Solubles - 3 | 19/5/70 | 6.0 | 480 | 30 | 450 | 600 | 43,000 |
| 0-1.41 | Oshawa Creek at Thomas Street<br>pH at Lab - 7.9<br>Chromium (Cr) - 0.25<br>Zinc (Zn) - 0.0<br>Lead (Pb) - 0.04<br>Cyanide (HCN) - <0.01<br>Ether Solubles - 0 | 19/5/70 | 7.5 | 460 | 40 | 420 | 300 | 2,300 |

Table I(a) Cont'd



| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| 0-1.71 | OSHAWA CREEK AT WENTWORTH STREET<br>PH AT LAB - 7.7<br>CHROMIUM (CR) - 5+ - 50%<br>ZINC (ZN) - 0.0<br>LEAD (PB) - 0.0<br>CYANIDE (HCN) - 0.00<br>ETHER SOLUBLES - 3 | 19/5/70 | 22.0 | 520 | 60 | 460 | 1,100 | 10,000 |
| 0-2.1 | OSHAWA CREEK UPSTREAM OF ROBSON LANG LEATHERS<br>PH AT LAB - 8.3<br>CHROMIUM (CR) - 0.05<br>ZINC (ZN) - 0.03<br>LEAD (PB) - 0.0<br>CYANIDE (HCN) - 0.00<br>ETHER SOLUBLES - 4 | 19/5/70 | 1.4 | 370 | 15 | 355 | 290 | 2,600 |
| 0-2.21 | OSHAWA CREEK UPSTREAM OF WHITING AVENUE STORM SEWER OUTFALL<br>PH AT LAB - 8.6<br>CHROMIUM (CR) - <0.03<br>ZINC (ZN) - 0.02<br>LEAD (PB) - 0.0<br>CYANIDE (HCN) - 0.00<br>ETHER SOLUBLES - 2 | 19/5/70 | 1.2 | 390 | 10 | 380 | 260 | 1,800 |
| 0-2.6 | OSHAWA CREEK ABOVE BLOOR STREET<br>CHROMIUM (CR) - 0.04<br>ZINC (ZN) - 0.01<br>LEAD (PB) - 0.0<br>CYANIDE (HCN) - <0.1 | 19/5/70 | 2.0 | 360 | 10 | 350 | 390 | 1,400 |
| 0-3.1 | OSHAWA CREEK OPPOSITE END OF HIBBERT AVENUE | 19/5/70 | 1.4 | 360 | 15 | 345 | 220 | 3,500 |

Table I(a) Cont'd



| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| 0-3.2 | Oshawa Creek above Confluence of Goodman Creek | 19/5/70 | 2.5 | 330 | 15 | 315 | 320 | 1,700 |
| 0-3.41 | Oshawa Creek above Gibb Street<br>Iron (Fe) - 0.45 | 19/5/70 | 3.0 | 350 | 20 | 330 | --- | 1,900 |
| 0-3.89 | Oshawa Creek Downstream of King Street<br>Chromium (Cr) - 0.0<br>Lead (Pb) - 0.0<br>Cyanide (HCN) - 0.00 | 19/5/70 | 1.4 | 390 | 5 | 385 | --- | 2,200 |
| 0-3.95 | Oshawa Creek between Bond Street and King Street<br>Chromium (Cr) - 0.0<br>Zinc (Zn) - 0.0<br>Lead (Pb) - 0.0<br>Cyanide (HCN) - <0.01 | 19/5/70 | 1.2 | 540 | 15 | 525 | 1,300 | 3,600 |
| 0-4.15 | Oshawa Creek East of Civic Stadium | 19/5/70 | 0.8 | 340 | 5 | 335 | 160 | 800 |
| 0-4.41 | Oshawa Creek above Adelaide Street | 19/5/70 | 2.2 | 330 | 25 | 305 | 70 | 290 |
| 0-5.5 | Oshawa Creek above Rossland Road | 19/5/70 | 2.0 | 340 | 10 | 330 | 92 | 240 |
| 0-6.98 | Oshawa Creek below Tauton Road | 19/5/70 | 1.2 | 410 | 5 | 405 | 116 | 900 |
| 0-7.02 | Oshawa Creek above Tauton Road | 19/5/70 | 1.6 | 330 | 10 | 320 | 88 | 148 |
| 0-7.28 | Oshawa Creek above Confluence with East Branch | 19/5/70 | 1.6 | 350 | 5 | 345 | 80 | 176 |

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| OE-7.9 | OSHAWA CREEK EAST BRANCH AT SIMCOE STREET NORTH | 19/5/70 | 1.2 | 340 | 5 | 335 | 176 | 1,200 |
| OE-8.9 | OSHAWA CREEK EAST BRANCH AT RITSON ROAD | 19/5/70 | 1.0 | 310 | 5 | 305 | 136 | 140 |

All analyses reported in ppm
except where indicated

City of Oshawa

Water Pollution Survey

Table I(b) Outfalls to Oshawa Creek
Samples Collected by: J. Clarke
F. Burford
A. McConnell
L. Murray

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| 0-0.4IW(S) | STORM SEWER OUTFALL AT SIMCOE STREET SOUTH ON SOUTH WEST SIDE | 19/5/70 | | NO | FLOW | | | |
| 0-0.4ID | DRAINAGE DITCH AT SIMCOE STREET SOUTH TO NORTH BANK | 19/5/70 | 2.0 | 320 | 5 | 315 | 744 | 2,600 |
| 0-0.4IW(N) | STORM SEWER OUTFALL AT SIMCOE STREET SOUTH DRAINING TO SWAMP<br>ZINC (ZN) - 0.05 | 19/5/70 | 5.0 | 270 | 20 | 250 | <4 | 232 |
| 0-0.8W | STORM SEWER OUTFALL AT SOUTH END OF RITSON ROAD | 19/5/70 | 0.6 | 810 | 5 | 805 | 36 | 232 |
| 0-1.2W | STORM SEWER OUTFALL OPPOSITE THE EAST END OF SCUGOG AVENUE | 19/5/70 | 1.2 | 960 | 10 | 950 | 1,170 | 10,800 |
| 0-1.4W | STORM SEWER OUTFALL AT THOMAS STREET TO WEST BANK | 19/5/70 | 0.6 | 1,040 | 5 | 1,035 | 150 | 2,400 |
| 0-1.7W(E) | STORM SEWER OUTFALL AT WENTWORTH STREET TO EAST BANK<br>PH AT LAB - 7.7<br>ZINC (ZN) - 0.03 | 19/5/70 | 8.0 | 610 | 5 | 605 | 128 | 8,000 |
| 0-1.7W(W) | STORM SEWER OUTFALL AT WENTWORTH STREET TO WEST BANK | 19/5/70 | | NO | FLOW | | | |

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| 0-1.81(A) | Outfall From Robson Lang Leathers<br>pH at Lab - 8.0<br>Chromium (CR) - <0.1<br>Zinc (ZN) - 0.03<br>Lead (PB) - 0.0<br>Cyanide (HCN) - 0.00<br>Ether Solubles - 6 | 19/5/70 | 4.5 | 460 | 25 | 435 | 350 | 33,000 |
| 0-1.811(B) | Outfall From Robson Lang Leathers<br>pH at Lab - 10.6<br>Chromium (CR) - 8.0<br>Zinc (ZN) - 0.07<br>Lead (PB) - 0.0<br>Cyanide (HCN) - 0.00<br>Ether Solubles - 34 | 19/5/70 | 700 | 5,560 | 390 | 5,170 | <100 | <100 |
| 0-2.2W | Storm Sewer Outfall Near End of Whiting Avenue<br>pH at Lab - 8.3<br>Chromium (CR) - 3.1<br>Zinc (ZN) - 0.08<br>Lead (PB) - 0.0<br>Cyanide (HCN) - 0.00<br>Ether Solubles - 2 | 19/5/70 | 3.0 | 290 | 10 | 280 | 10 | 140 |
| 0-2.4W | Storm sewer Outfall At Corner of Malaga Road and Glen Street<br>Chromium (CR) - 0.0<br>Zinc (ZN) - 0.0<br>Lead (PB) - 0.0<br>Cyanide (HCN) - 0.00 | 19/5/70 | 2.5 | 450 | 10 | 440 | 6600 | 11,400 |

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | TOTAL |
|---|---|---|---|---|---|---|---|---|
| 0-2.45W | STORM SEWER OUTFALL AT END OF ERIE STREET | 19/5/70 | | | NO FLOW | | | |
| 0-2.5W | STORM SEWER OUTFALL AT END OF VALENCIA ROAD<br>CHROMIUM (CR) - 0.04<br>ZINC (ZN) - 0.0<br>LEAD (PB) - 0.0<br>CYANIDE (HCN) - <0.00 | 19/5/70 | 1.2 | 720 | 25 | 695 | 4 | 3,000 |
| 0-2.6W(E) | STORM SEWER OUFTALL AT BLOOR STREET WEST TO EAST BANK<br>CHROMIUM (CR) - 0.03<br>ZINC (ZN) - 0.0<br>LEAD (PB) - 0.0<br>CYANIDE (HCN) - <0.01 | 19/5/70 | 2.5 | 1,280 | 5 | 1,275 | 1,240 | 9,700 |
| 0-2.6W(W) | STORM SEWER OUTFALL AT BLOOR STREET WEST TO WEST BANK<br>CHROMIUM (CR) - 0.06<br>ZINC (ZN) - 0.25<br>LEAD (PB) - 0.0<br>CYANIDE (HCN) - <0.01 | 19/5/70 | 1.8 | 640 | 5 | 635 | 1,100 | 6,300 |
| 0-3.0W | STORM SEWER OUTFALL AT MILL STREET | 19/5/70 | | | NO FLOW | | | |
| 0-3.17W | STORM SEWER OUTFALL AT END OF SINCLAIR AVENUE | 19/5/70 | | | NO FLOW | | | |
| 0-3.21W | STORM SEWER OUTFALL AT END OF AVENUE STREET | 19/5/70 | | | NO FLOW | | | |

Table I(b) Cont'd



| SAMPLING POINT NO | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | TOTAL |
|---|---|---|---|---|---|---|---|---|
| 0-3.25W | STORM SEWER OUTFALL AT END OF ROYAL STREET | 19/5/70 | | NO FLOW | | | | |
| 0-3.35W | STORM SEWER OUTFALL AT END OF QUEBEC STREET | 19/5/70 | | NO FLOW | | | | |
| 0-3.4W(E) | STORM SEWER OUTFALL AT GIBB STREET TO EAST BANK | 19/5/70 | | NO FLOW | | | | |
| 0-3.4W(W) | STORM SEWER OUTFALL AT GIBB STREET TO WEST BANK | 19/5/70 | | NO FLOW | | | | |
| 0-3.54W | STORM SEWER OUTFALL AT END OF LLOYD STREET | 19/5/70 | 1.0 | 1,100 | 5 | 1,095 | -- | 10,400 |
| 0-3.6W(W) | STORM SEWER OUTFALL AT JOHN STREET TO WEST BANK | 19/5/70 | 1.4 | 1,000 | 10 | 1,270 | -- | 2,700 |
| 0-3.6W(E) | STORM SEWER OUTFALL AT JOHN STREET TO EAST BANK | 19/5/70 | 9.0 | 370 | 10 | 360 | -- | 6,600 |
| 0-3.8W | STORM SEWER OUTFALL AT MIDTOWN DRIVE | 19/5/70 | | NOT SAMPLED - SUBMERGED OUTFALL | | | | |
| 0-3.81W | STORM SEWER OUTFALL ADJACENT TO WEST END OF ATHOL STREET<br>ANIONIC DETERGENTS (ABS) - 2.0 | 19/5/70 | 5.0 | 260 | 15 | 245 | -- | <4 |
| 0-3.9W(E) | STORM SEWER OUTFALL AT KING ST TO EAST BANK<br>CHROMIUM (CR) - 0.0<br>LEAD (PB) - 0.0<br>CYANIDE (HCN) - 0.00 | 19/5/70 | 3.0 | 1,180 | 5 | 1,175 | -- | 2,500 |

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| 0-3.9W(W) | STORM SEWER OUTFALL AT KING STREET WEST TO WEST BANK | 19/5/70 | NOT SAMPLED - OUTFALL SUBMERGED | | | | | |
| 0-4.0W(E) | STORM SEWER OUTFALL AT BOND STREET WEST TO EAST BANK<br>CHROMIUM (CR) - 0.08<br>ZINC (ZN) - 0.06<br>LEAD (PN) - 1.4<br>CYANIDE (HCN) - <0.01<br>PHENOLS (PPB) - 7<br>ETHER SOLUBLES - 4 | 19/5/70 | 4.5 | 4,060 | 70 | 3,990 | 1,200 | 29,000 |
| 0-4.0W(W) | STORM SEWER OUTFALL AT BOND STREET WEST TO WEST BANK<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - 0.0<br>LEAD (PB) - 0.C<br>CYANIDE (HCN) - <0.01<br>PHENOLS IN PPB - 6<br>ETHER SOLUBLES - 4 | 19/5/70 | 1.8 | 950 | 5 | 945 | 80 | 134,000 |
| 0-4.031 | OUTFALL FROM AUTO-MAGIC CAR WASH | 19/5/70 | 220 | 810 | 500 | 310 | 70 | 29,000 |
| 0-4.1W | STORM SEWER OUTFALL AT END OF WILLIAM STREET<br>CHROMIUM (CR) - 0.04<br>ZINC (ZN) - 0.0<br>LEAD (PB) - 0.0<br>CYANIDE (HCN) - <0.01 | 19/5/70 | 1.0 | 1,060 | 5 | 1,055 | 6,600 | 12,100 |
| 0-4.2W | STORM SEWER OUTFALL AT COLBORNE STREET TO WEST BANK | 19/5/70 | 6.5 | 770 | 5 | 765 | 36 | 156 |

Table I(b) Cont'd



| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| 0-4.3W | Storm Sewer Outfall At Elgin Street To East Bank | 19/5/70 | | | NOT LOCATED | | | |
| 0-4.4W(E) | Storm Sewer Outfall At Adelaide Street West To East Bank | 19/5/70 | 2.0 | 590 | 10 | 580 | <4 | <10 |
| 0-4.4W(W) | Storm Sewer Outfall At Adelaide Street West To West Bank | 19/5/70 | 1.0 | 1,180 | 10 | 1,170 | 132 | 300 |
| 0-4.54W | Storm Sewer Outfall At Alma Street | 19/5/70 | | | NO FLOW | | | |
| 0-4.55W | Storm Sewer Outfall At Ridgeway Avenue | 19/5/70 | 1.4 | 1,110 | 5 | 1,105 | 6600 | 11,400 |
| 0-4.6W | Storm Sewer Outfall At Alexandra Street | 19/5/70 | 5.0 | 450 | 5 | 445 | 19,000 | 43,000 |
| 0-4.65W | Storm Sewer Outfall Just North of Alexandra Street | 19/5/70 | 0.4 | 530 | 5 | 525 | 4 | 40 |
| 0-4.75W | Storm Sewer Outfall At Walmer Road | 19/5/70 | | | NO FLOW | | | |
| 0-5.5W(E) | Storm Sewer Outfall At Rossland Road West to East Bank | 19/5/70 | 4.0 | 1,020 | 10 | 1,010 | 24,000 | 39,000 |
| 0-5.5W(W) | Storm Sewer Outfall At Rossland Road West to West Bank | 19/5/70 | 1.2 | 930 | 5 | 925 | 8 | 60 |
| 0-5.58W | Storm Sewer Outfall West of Ansle Crescent | 19/5/70 | | | NO FLOW | | | |
| 0-5.8W | Storm Sewer Outfall Southwest of Glenwood Crescent | 19/5/70 | 1.6 | 950 | 5 | 945 | 148 | 4,800 |

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| 0-6.1W | Storm Sewer Outfall To Switzer Drive | 19/5/70 | | | | | <4 | 40 |
| 0-7W | Storm Sewer Outfall At Tauton Road | 19/5/70 | 0.6 | 1,030 | 5 | 1,025 | 252 | 3,400 |
| 0E-7.9W | Storm Sewer Outfall To East Branch Of Oshawa Creek At Simcoe Street North | 19/5/70 | | | NO FLOW | | | |

All analyses reported in ppm
except where indicated

City of Oshawa

Table II(a) Goodman Creek
Samples Collected by: F. Burford

## Water Pollution Survey

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| OG-3.1 | GOODMAN CREEK AT CONFLUENCE WITH OSHAWA CREEK | 11/5/70 | 3.0 | 530 | 5 | 525 | 610 | 16,000 |
| OG-3.55 | GOODMAN CREEK AT PARK ROAD | 11/5/70 | 3.5 | 500 | 10 | 490 | 440 | 28,000 |
| OG-4.2 | GOODMAN CREEK AT STEVENSON'S ROAD | 11/5/70 | 2.0 | 410 | 10 | 400 | 16 | 280 |
| OG-4.69 | GOODMAN CREEK SOUTH SIDE OF HIGHWAY 2 | 11/5/70 | 0.3 | 4 | 10 | 430 | 12 | 1,300 |
| OG-4.71 | GOODMAND CREEK NORTH SIDE OF HIGHWAY 2 | 11/5/70 | 0.3 | 430 | 10 | 420 | 12 | 100 |
| OG-5.55 | GOODMAN CREEK AT ADELAIDE STREET | 11/5/70 | 1.0 | 420 | 10 | 410 | 40 | 70 |
| OG-6.7 | GOODMAN CREEK AT ROSSLAND ROAD | 11/5/70 | 0.4 | 390 | 5 | 385 | <4 | 12 |
| OG-6.8 | TRIBUTARY OF GOODMAN CREEK | 11/5/70 | 1.4 | 440 | 5 | 435 | 104 | 220 |
| OG-7.94 | TIRBUTARY OF GOODMAN CREEK AT THORNTON ROAD | 11/5/70 | 11.0 | 680 | 220 | 460 | 13,000 | 44,000 |
| OG-8.3 | GOODMAN CREEK AT TAUNTON ROAD | 11/5/70 | 17.0 | 490 | 10 | 480 | 10 | 2,400 |

All analyses reported in ppm
except where indicated

City of Oshawa

Water Pollution Survey

Outfalls to Goodman Creek
Table II(b)
Samples Collected by: F. Burford

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| OG-3.5W(N) | STORM SEWER OUTFALL AT PARK ROAD TO NORTH BANK | 11/5/70 | | | NO FLOW | | | |
| OG-3.5W(S) | STORM SEWER OUTFALL AT PARK ROAD TO SOUTH BANK | 11/5/70 | | | NO FLOW | | | |
| OG-3.6W | STORM SEWER OUTFALL FROM MONTRAVE AVENUE TO NORTH BANK PHENOLS (PPB) - 10 | 11/5/70 | 5.5 | 540 | 10 | 530 | 30 | 3,300 |
| OG-3.8W | STORM SEWER OUTFALL TO NORTH BANK JUST WEST OF GRENFELL STREET | 11/5/70 | 10. | 740 | 5 | 735 | 160 | 680 |
| OG-4.0W | STORM SEWER OUTFALL TO SOUTH BANK EAST SIDE OF STEVENSON ROAD | 11/5/70 | --- | --- | -- | --- | 152 | 280 |
| OG-4.1W | STORM SEWER OUTFALL TO WEST BANK FROM RADISSON AVENUE | 11/5/70 | | | NO FLOW | | | |
| OG-4.2W | STORM SEWER OUTFALL AT SOUTHWEST CORNER OF GIBB STREET AND STEVENSON ROAD | 11/5/70 | | | NO FLOW | | | |
| OG-4.23W(W) | STORM SEWER OUTFALL FROM GIBB STREET TO WEST BANK PHENOLS (PPB) - 15 | 11/5/70 | 1.6 | 490 | 70 | 420 | 10 | 1,010 |
| OG-4.23W(E) | STORM SEWER OUTFALL AT DURHAM STREET TO EAST BANK | 11/5/70 | | | NO FLOW | | | |
| OG-4.4W(W) | STORM SEWER OUTFALL AT CARTIER AVENUE TO WEST BANK | 11/5/70 | 1.4 | 440 | 15 | 425 | 40 | 750 |

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | TOTAL |
|---|---|---|---|---|---|---|---|---|
| OG-4.4W(E) | STORM SEWER OUTFALL AT CARTIER AVENUE TO EAST BANK | 11/5/70 | | | NO FLOW | | | |
| OG-4.6W(W) | STORM SEWER OUTFALL AT MONTCALM AVENUE TO WEST BANK | 11/5/70 | | | NO FLOW | | | |
| OG-4.6W(E) | STORM SEWER OUTFALL AT MONTCALM AVENUE TO EAST BANK | 11/5/70 | | | NO FLOW | | | |
| OG-4.6W(N) | STORM SEWER OUTFALL AT CABOT STREET TO NORTH BANK | 11/5/70 | | | NO FLOW | | | |
| OG-4.7W(W) | STORM SEWER OUTFALL AT HIGHWAY 2 TO WEST BANK | 11/5/70 | | | NO FLOW | | | |
| OG-4.7W(E) | STORM SEWER OUTFALL AT HIGHWAY 2 TO EAST BANK | 11/5/70 | 6.0 | 590 | 100 | 490 | 3,300 | 80,000 |
| OG-6.0W | STORM SEWER OUTFALL AT END OF RIDGEWAY AVENUE | 11/5/70 | --- | --- | -- | --- | <4 | 140 |
| OG-6.08W | STORM SEWER OUTFALL AT END OF DUNDEE AVENUE | 11/5/70 | --- | --- | -- | --- | 12 | 200 |
| OG-6.25W | STORM SEWER OUTFALL AT END OF ANNAPOLIS AVENUE | 11/5/70 | --- | --- | -- | --- | 52 | 1,200 |
| OG-8.3W(W) | STORM SEWER OUTFALL AT TAUTON ROAD TO WEST BANK | 11/5/70 | | | NO FLOW | | | |
| OG-8.3W(E) | STORM SEWER OUTFALL AT TAUTON ROAD TO EAST BANK | 11/5/70 | 0.6 | 990 | 5 | 985 | 32 | 232 |

All analyses reported in ppm
except where indicated

City of Oshawa

Table III(a) St. Julian Drain
Samples Collected by: J. A. Clarke

Water Pollution Survey

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| OS-0.5 | ST. JULIAN DRAIN AT HARBOUR ROAD<br>PH AT LAB - 7.7<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - 0.37<br>LEAD (PB) - 0.0<br>ETHER SOLUBLES - 5<br>PHENOLS (PPB) - 0 | 11/5/70 | 4.0 | 650 | 15 | 635 | 280 | 2,500 |
| OS-0.9 | ST. JULIAN DRAIN AT WATERLOO STREET<br>PH AT LAB - 7.9<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - 0.24<br>LEAD (PB) - 0.0<br>ETHER SOLUBLES - 9<br>PHENOLS (PPB) - 0 | 11/5/70 | 5.5 | 490 | 15 | 475 | 1,700 | 4,800 |
| OS-1.05 | ST. JULIAN DRAIN AT WENTWORTH STREET<br>PH AT LAB - 7.5<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - 0.32<br>LEAD (PB) - 0.0<br>ETHER SOLUBLES - 9<br>PHENOLS (PPB) - 0 | 11/5/70 | 5.0 | 550 | 15 | 535 | 3,400 | 4,700 |
| OS-1.2 | ST. JULIAN DRAIN BELOW CNR<br>PH AT LAB - 7.5<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - 0.32<br>LEAD (PB) - 0.0<br>ETHER SOLUBLES - 20<br>PHENOLS (PPB) - 6 | 11/5/70 | 13 | 410 | 30 | 380 | 500 | 2,900 |

All analyses reported in ppm
except where indicated

City of Oshawa

Water Pollution Survey

Table III(b) Outfalls to
St. Julian Drain
Samples Collected by: J. A. Clarke

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| OS-0.9W | WATERLOO STREET STORM SEWER OUTFALL | 11/5/70 | | | NO FLOW | | | |
| OS-1.1W | WENTWORTH STREET STORM SEWER OUTFALL | 11/5/70 | 5.0 | 1,830 | 690 | 1,140 | 10 | 80 |
| OS-1.3W | CONANT STREET STORM SEWER OUTFALL | 11/5/70 | 4.0 | 980 | 20 | 960 | 1,200 | 1,060,000 |
| OS-1.5W(E) | BLOOR STREET EAST OUTFALL<br>PH AT LAB - 7.6<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - .14<br>LEAD (PB) - 0.0<br>ETHER SOLUBLES - TRACE<br>PHENOLS (PPB) - 8 | 11/5/70 | 2.0 | 1,070 | 15 | 1,055 | 5,400 | 13,500 |
| OS-1.5W(W) | BLOOR STREET WEST OUTFALL<br>PH AT LAB - 7.4<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - 5.8<br>LEAD (PB) - 0.0<br>ETHER SOLUBLES - 48<br>PHENOLS (PPB) - 9 | 11/5/70 | 38 | 400 | 50 | 350 | 320 | 3,100 |

All analyses reported in ppm except where indicated

Samples Collected by;
F. Burford
J. A. Clarke

City of Oshawa

Water Pollution Survey

Stream Samples Table IV(a)
Harmony Creek - H
Dean Avenue Branch - Harmony Creek - HD
Farewell Creek - HF
West Branch - Harmony Creek - HW
Northwest Branch - Harmony Creek - HW[illegible]

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| H-0.00 | HARMONY CREEK (MAIN BR) AT MOUTH<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - 0.12<br>LEAD (PB) - 0.0 | 20/5/70 | 10 | 540 | 15 | 525 | 11,000 | 106,000 |
| H-1.1 | HARMONY CREEK (MAIN BR) AT WENTWORTH STREET EAST<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - 0.0<br>LEAD (PB) - 0.0 | 20/5/70 | 1.8 | 530 | 25 | 505 | 92 | 190 |
| HD-1.95 | DEAN AVENUE DRAINAGE COURSE AT BLOOR STREET EAST<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - 0.0<br>LEAD (PB) - 0.0 | 20/5/70 | 1.2 | 810 | 5 | 805 | 84 | 192 |
| HD-2.07 | DEAN AVENUE DRAINAGE COURSE NORTH OF DEAN AVENUE | 20/5/70 | 0.8 | 720 | 5 | 715 | 164 | 700 |
| HF-1.01 | FAREWELL CREEK ABOVE WENTWORTH STREET EAST | 20/5/70 | 1.0 | 400 | 30 | 370 | 76 | 76 |
| HF-1.70 | FAREWELL CREEK AT BLOOR STREET EAST | 20/5/70 | 1.2 | 350 | 10 | 340 | 56 | 76 |
| HF-2.16 | FAREWELL CREEK AT GRANDVIEW STREET SOUTH | 20/5/70 | 1.0 | 330 | 5 | 325 | 36 | 60 |
| HF-2.9 | FAREWELL CREEK AT TOWNLINE ROAD SOUTH | 20/5/70 | 1.6 | 330 | 5 | 325 | 52 | 80 |
| H-2.98 | HARMONY CREEK (MAIN BR) AT OLIVE AVENUE | 20/5/70 | 0.9 | 450 | 5 | 445 | 36 | 72 |

Table IV(a) Cont'd 

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| H-3.18 | HARMONY CREEK (MAIN BR) BELOW CONFLUENCE OF WEST BRANCH OF HARMONY CREEK | 20/5/70 | 0.8 | 475 | 5 | 470 | 48 | 84 |
| H-3.42 | HARMONY CREEK (MAIN BR) ABOVE CONFLUENCE OF WEST BRANCH OF HARMONY CREEK | 20/5/70 | 1.0 | 440 | 10 | 430 | 64 | 88 |
| H-3.72 | HARMONY CREEK (MAIN BR) AT KING STREET EAST | 20/5/70 | 1.0 | 440 | 5 | 435 | 70 | 190 |
| H-4.16 | A SMALL TRIBUTARY TO HARMONY CREEK (MAIN BR) NEAR LAUREL COURT | 20/5/70 | 0.6 | 390 | 5 | 385 | 12 | 96 |
| H-5.14 | HARMONY CREEK (MAIN BR) AT TOWNLINE ROAD NORTH | 20/5/70 | 0.8 | 390 | 5 | 385 | 180 | 300 |
| HW-3.3 | HARMONY CREEK (WEST BR) ABOVE CONFLUENCE WITH MAIN BRANCH | 20/5/70 | 0.8 | 580 | 5 | 575 | 80 | 390 |
| HW-3.98 | HARMONY CREEK (WEST BR) BETWEEN KING STREET EAST AND BOND STREET EAST | 12/5/70 | 1.4 | 520 | 5 | 515 | <4 | 800 |
| HW-4.12 | HARMONY CREEK (WEST BR) NORTH OF BOND STREET EAST | 12/5/70 | 1.0 | 420 | 5 | 415 | <4 | 1,000 |
| HW-4.56 | HARMONY CREEK (WEST BR) AT ADELAIDE AVENUE EAST | 12/5/70 | 1.2 | 370 | 10 | 360 | 16 | 140 |
| HW-4.64 | HARMONY CREEK (WEST BR) HARMONY ROAD TRIBUTARY | 12/5/70 | 1.0 | 340 | 5 | 335 | 4 | 110 |
| HW-5.01 | HARMONY CREEK (WEST BR) HARMONY ROAD TRIBUTARY, AT HARMONY ROAD NORTH | 24/6/70 | --- | --- | -- | --- | 104 | 1,800 |

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| HW-6.00 | HARMONY CREEK (WEST BR) HARMONY ROAD TRIBUTARY, ABOVE OSHAWA INDUSTRIAL DISPOSAL SITE | 24/6/70 | --- | --- | -- | --- | 1,300 | 3,300 |
| HW-5.52 | HARMONY CREEK (WEST BR) WILSON ROAD TRIBUTARY AT ROSSLAND ROAD EAST | 12/5/70 | 1.0 | 310 | 5 | 305 | 4 | 30 |
| HWO-4.18 | HARMONY CREEK (NORTHWEST BR) ABOVE CONFLUENCE WITH WEST BRANCH | 12/5/70 | 2.0 | 590 | 10 | 580 | 320 | 570 |
| HWO-4.76 | HARMONY CREEK (NORTHWEST BR) AT ADELAIDE AVENUE EAST | 12/5/70 | 2.5 | 600 | 15 | 685 | 180 | 500 |
| HWO-5.10 | HARMONY CREEK (NORTHWEST BR) ABOVE CONFLUENCE WITH MOST WESTERLY TRIBUTARY | 12/5/70 | 1.6 | 840 | 140 | 700 | 70 | 700 |
| HWO-5.58 | HARMONY CREEK (NORTHWEST BR) AT ROSSLAND ROAD EAST | 12/5/70 | 5.0 | 880 | 130 | 750 | 140 | 6,400 |
| HWO-5.61 | HARMONY CREEK (NORTHWEST BR) AT ROSSLAND ROAD EAST | 12/5/70 | 3.0 | 530 | 15 | 515 | <4 | 4,400 |
| HWO-5.09 | HARMONY CREEK (NORTHWEST BR) END OF VOLENDAM AVENUE | 12/5/70 | 2.5 | 580 | 10 | 570 | 76 | 1,800 |
| HWO-5.51 | HARMONY CREEK (NORTHWEST BR) WEST OF WYCHWOOD STREET | 12/5/70 | 1.4 | 520 | 5 | 515 | <4 | 2,700 |
| HWO-5.81 | HARMONY CREEK (NORTHWEST BR) SOUTH OF ROSSLAND ROAD | 12/5/70 | 0.8 | 500 | 5 | 495 | 28 | 2,500 |

Table IV(a)



| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| HWO-5.91 | HARMONY CREEK (NORTHWEST BR) TRIBUTARY NORTH OF ROSSLAND ROAD AND WEST OF RITSON ROAD | 12/5/70 | 0.6 | 590 | 5 | 585 | <4 | 5,700 |
| HWO-6.43 | RITSON ROAD TRIBUTARY HARMONY CREEK (NORTHWEST BR) | 12/5/70 | 0.6 | 570 | 5 | 565 | <4 | 72 |
| HWO-6.38 | HARMONY CREEK (NORTHWEST BR) AT OSHAWA BOULEVARD NORTH | 12/5/70 | 1.2 | 540 | 15 | 525 | 40 | 370 |
| HWO-6.75 | HARMONY CREEK (NORTHWEST BR) TRIBUTARY BEHIND MARCIA AVENUE | 12/5/70 | 1.8 | 470 | 10 | 460 | 12 | 110 |
| HWO-6.87 | HARMONY CREEK (NORTHWEST BR) AT BEATRICE STREET | 12/5/70 | 1.8 | 780 | 5 | 775 | 180 | 1,500 |
| HWO-6.93 | HARMONY CREEK (NORTHWEST BR) AT NONQUON ROAD | 12/5/70 | 1.4 | 490 | 5 | 485 | 96 | 1,200 |

All analyses reported in ppm except where indicated

Samples Collected by:
F. Burford
J. A. Clarke

City of Oshawa

Water Pollution Survey

Outfalls to: Table IV(b)
Harmony Creek (North West Branch -HWO
Harmony Creek (Main Branch) - H
Dean Avenue Drain - HD
Farewell Creek - HF
Harmony Creek (West Branch)- HW

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | TOTAL |
|---|---|---|---|---|---|---|---|---|
| H-0.9T | MUNICIPAL SEWAGE TREATMENT PLANT OUTFALL<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - 0.9<br>LEAD (PB) - 0.0 | 20/5/70 | 32.0 | 620 | 35 | 585 | 19,000 | 230,000 |
| H-1.25W | STORM SEWER OUTFALL AT WENTWORTH STREET | 20/5/70 | 1.0 | 1,030 | 5 | 1,025 | 24 | 72 |
| H-1.35W | STORM SEWER OUTFALL AT RALEIGH AVENUE | 20/5/70 | 1.0 | 510 | 10 | 500 | <4 | <4 |
| HD-2.05W(E) | STORM SEWER EAST SIDE DEAN AVENUE DRAIN ABOVE HIGHWAY 401 | 20/5/70 | 1.6 | 740 | 5 | 735 | 92 | 1,200 |
| HD-2.05W(W) | STORM SEWER WEST SIDE DEAN AVENUE DRAIN ABOVE HIGHWAY 401 | 20/5/70 | 1.2 | 710 | 5 | 705 | 102 | 1,100 |
| HD-2.30W | STORM SEWER OUTFALL AT KINGSIDE PARK | 20/5/70 | 1.4 | 870 | 10 | 860 | 7,800 | 8,800 |
| HD-2.30W | STORM SEWER OUTFALL AT TENNYSON AVENUE<br>CHROMIUM (CR) - 0.0<br>ZINC (ZN) - 0.1<br>LEAD (PB) - 0.0 | 20/5/70 | 2.0 | 670 | 5 | 665 | 48,000 | 52,000 |
| HF-2.21W | STORM SEWER OUTFALL AT GRANDVIEW STREET SOUTH | 20/5/70 | 1.0 | 330 | 5 | 325 | 104 | 108 |
| H-1.90W | STORM SEWER OUTFALL AT BLOOR STREET EAST | 20/5/70 | | | NO FLOW | | | |

Table IV(b) Cont'd



| SAMPLING POINT NO | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| H-2.60W | STORM SEWER OUTFALL AT END OF HARCOURT DRIVE | 20/5/70 | | | NO FLOW | | | |
| H-2.70W | STORM SEWER OUTFALL WEST OF DIANNE DRIVE | 20/5/70 | 1.8 | 1,010 | 5 | 1,005 | 60 | 350 |
| H-2.77W | STORM SEWER OUTFALL EAST OF FLORELL DRIVE | 20/5/70 | | | NO FLOW | | | |
| H-2.88W | STORM SEWER OUTFALL AT OLIVE AVENUE | 20/5/70 | | | GOOD FLOW - UNABLE TO SAMPLE | | | |
| H-3.06W | STORM SEWER OUTFALL EAST OF WALNUT COURT | 20/5/70 | -- | -- | -- | -- | 16 | 16 |
| H-3.44W | STORM SEWER OUTFALL AT WEST END OF WILLOWDALE AVENUE | 20/5/70 | 0.8 | 780 | 5 | 755 | 68 | 1,300 |
| H-3.72W(E) | STORM SEWER OUTFALL AT KING STREET EAST TO EAST SIDE OF CREEK | 20/5/70 | | | NO FLOW | | | |
| H-3.72W(W) | STORM SEWER OUTFALL AT KING STREET EAST TO WEST SIDE OF CREEK | 20/5/70 | | | NO FLOW | | | |
| H-3.82W | STORM SEWER OUTFALL EAST END OF BEAUFORT AVENUE | 20/5/70 | -- | -- | -- | -- | 30 | 960 |
| H-3.98W | STORM SEWER OUTFALL AT REGENT DRIVE | 20/5/70 | | | NO FLOW | | | |
| H-4.08D | DRAINAGE DITCH AT EAST END OF PARKLANE AVENUE | 20/5/70 | 5.5 | 810 | 25 | 785 | <4 | <4 |

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | TOTAL |
|---|---|---|---|---|---|---|---|---|
| H-4.2W | Storm Sewer Outfall At North End of Keewatin Street | 29/5/70 | --- | --- | -- | --- | 4 | 12 |
| H-4.6W | Storm Sewer Outfall Opposite Oshawa Missionary College | 20/5/70 | 30.0 | 720 | 15 | 705 | 8 | 1,432 |
| H-4.7W | Storm Sewer Outfall At Rockcliffe Street | 20/5/70 | 0.6 | 960 | 5 | 955 | 570 | 540 |
| HW-3.42W | Storm Sewer Outfall At Harmony Road | 12/5/70 | | | NO FLOW | | | |
| HW-3.58W | Storm Sewer Outfall North Of Linden Court | 12/5/70 | | | NO FLOW | | | |
| HW-3.62W | Storm Sewer Outfall East of Farewell Street South of Hoskin Avenue | 12/5/70 | | | NO FLOW | | | |
| HW-3.67W | Storm Sewer Outfall At End of Hoskin Avenue | 12/5/70 | | | NO FLOW | | | |
| HW-3.84W | Storm Sewer Outfall At East End Of Athol Street East | 12/5/70 | | | NO FLOW | | | |
| HW-3.96W(E) | Storm Sewer Outfall At King Street East To East Bank | 12/5/70 | | | NO FLOW | | | |
| HW-3.96W(W) | Storm Sewer Outfall At King Street East To West Bank | 12/5/70 | --- | --- | -- | --- | <4 | 2,100 |
| HW-4.10W(E) | Storm Sewer Outfall At Bond Street East To East Bank | 12/5/70 | | | NO FLOW | | | |
| HW-4.10W(W) | Storm Sewer Outfall At Bond Street East To West Bank | 12/5/70 | | | NO FLOW | | | |

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | TOTAL |
|---|---|---|---|---|---|---|---|---|
| HW-4.36W | Storm Sewer Outfall at West End of Eastbourne Avenue | 12/5/70 | 0.8 | 1,060 | 10 | 1,050 | 20 | 70 |
| HW-4.56W | Storm Sewer Outfall at Adelaide Avenue East | 12/5/70 | | | NO FLOW | | | |
| HWO-4.38W | Storm Sewer Outfall South of Sussex Street | 12/5/70 | | | NO FLOW | | | |
| HWO-4.50W | Storm Sewer Outfall at Wilson Road North | 12/5/70 | | | NO FLOW | | | |
| HWO-4.52D | Drainage Ditch West Side of Wilson Road North | 12/5/70 | 2.0 | 830 | 5 | 825 | 4 | 204 |
| HWO-4.58W | Storm Sewer Outfall West of Lansdowne Drive and Wilson Road North | 12/5/70 | | | NO FLOW | | | |
| HWO-4.74W | Storm Sewer Outfall at Adelaide Avenue East, West of Wilson Road South | 12/5/70 | | | NO FLOW | | | |
| HWO-4.96W | Storm Sewer Outfall East of Arnhem Drive | 12/5/70 | | | NO FLOW | | | |
| HWO-5.06W | Storm Sewer Outfall Opposite East End of Volendam Avenue | 12/5/70 | | | NO FLOW | | | |
| HWO-5.38W(E) | Storm Sewer Outfall West of Beechwood Street | 12/5/70 | | | NO FLOW | | | |
| HWO-5.38W(W) | Storm Sewer Outfall East of Brentwood Avenue | 12/5/70 | | | NO FLOW | | | |
| HWO-5.6W | Storm Sewer Outfall at Rossland Road East, West of Wilson Road North | 26/11/70 | 24.0 | 2,730 | 130 | 2,600 | 50 | 2,400 |

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| HWO-5.19W | STORM SEWER OUTFALL SOUTH OF REMBRANDT COURT | 12/5/70 | | | NO FLOW | | | |
| HWO-5.23W | STORM SEWER OUTFALL NORTH OF VOLENDAM AVENUE AND EAST OF CENTRAL PARK BOULEVARD NORTH | 12/5/70 | 6.5 | 750 | 50 | 700 | 1,600 | 6,800 |
| HWO-5.27W(E) | STORM SEWER OUTFALL AT CENTRAL PARK BOULEVARD NORTH AND HILLCROFT STREET TO EAST BANK | 12/5/70 | | | NO FLOW | | | |
| HWO-5.27W(W) | STORM SEWER OUTFALL AT CENTRAL PARK BOULEVARD NORTH AND HILLCROFT STREET TO WEST BANK | 12/5/70 | | | NO FLOW | | | |
| HWO-5.49W | STORM SEWER OUTFALL EAST OF OSHAWA BOULEVARD NORTH | 12/5/70 | --- | --- | -- | --- | 96 | 1,100 |
| HWO-5.53W | STORM SEWER OUTFALL SOUTH END OF WYCHWOOD STREET | 12/5/70 | | | NO FLOW | | | |
| HWO-5.65W | STORM SEWER OUTFALL AT END OF HUMEWOOD AVENUE | 12/5/70 | | | NO FLOW | | | |
| HWO-5.75W | STORM SEWER OUTFALL AT RITSON ROAD NORTH, SOUTH OF ROSSLAND ROAD EAST | 12/5/70 | | | NO FLOW | | | |
| HWO-5.85W(E) | STORM SEWER OUTFALL AT ROSSLAND ROAD EAST TO EAST BANK | 12/5/70 | | | NO FLOW | | | |

| SAMPLING POINT NO. | LOCATION | DATE | BOD | SOLIDS TOTAL | SOLIDS SUSP. | SOLIDS DISSOLVED | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML FECAL | BACTERIOLOGICAL EXAMINATION COLIFORM BACTERIA PER 100 ML TOTAL |
|---|---|---|---|---|---|---|---|---|
| HWO-5.85W(W) | STORM SEWER OUTFALL AT ROSSLAND ROAD EAST TO WEST BANK | 12/5/70 | 0.4 | 810 | 5 | 805 | 236 | 1,800 |
| HWO-6.09W | STORM SEWER OUTFALL EAST OF OSHAWA BOULEVARD NORTH AND SOUTH OF DARCY STREET | 12/5/70 | --- | --- | -- | --- | 20 | 1,300 |
| HWO-6.17W | STORM SEWER OUTFALL AT DARCY STREET | 12/5/70 | --- | --- | -- | --- | 52 | 510 |
| HWO-6.39W | STORM SEWER OUTFALL AT OSHAWA BOULEVARD NORTH | 12/5/70 | --- | --- | -- | --- | 240 | 280 |
| HWO-6.47W | STORM SEWER OUTFALL NORTH EAST OF ROBERT STREET | 12/5/70 | 1.6 | 950 | 5 | 945 | 4 | 120 |
| HWO-6.71W | STORM SEWER OUTFALL END OF MARCIA AVENUE | 12/5/70 | 0.6 | 460 | 5 | 455 | 40 | 60 |
| HWO-6.85W | STORM SEWER OUTFALL AT BEATRICE STREET | 12/5/70 | --- | --- | -- | --- | <4 | <4 |
| HWO-6.91W | STORM SEWER OUTFALL AT NONQUON ROAD | 12/5/70 | 0.8 | 1,020 | 5 | 1,015 | 12 | 570 |

Oshawa Creek (Pertinent Samples) City of Oshawa Table V

Summary 1958 and 1963 Survey

All analyses reported in ppm unless otherwise noted

Water Pollution Survey

| SAMPLING POINT NO | DESCRIPTION OF SAMPLING POINTS | DATE | 5-DAY BOD | SOLIDS (PPM) TOTAL | SUSP | DISS | TOTAL COLIFORM COUNT PER 100 ML | PH | CHROME AS CR |
|---|---|---|---|---|---|---|---|---|---|
| 0-0.0 | OSHAWA CREEK AT HARBOUR MOUTH | 25/9/58 | 1.8 | 212 | 10 | 202 | 1,570 | | |
| | | 12/11/63 | 2.0 | 256 | 12 | 244 | 1,100 | | |
| 0.S.-0.5 | ST JULIAN DRAIN AT HARBOUR ROAD | 25/9/58 | 6.5 | 256 | 10 | 246 | 20,000 | 11.0 | 0 |
| | '58 '63 | 12/11/63 | 15.0 | 678 | 26 | 652 | 19,000 | 7.2 | 0.02 |
| | ARSENIC (AS) - 0.04 0.C | | | | | | | | |
| | CYANIDE (HCN)- 0 -- | | | | | | | | |
| | LEAD (PB) - TRACE -- | | | | | | | | |
| | ETHER SOLUBLES-19 TRACE | | | | | | | | |
| 0.S.-1.3W | CONANT STREET STORM SEWER OUTFALL | 25/9/58 | 50.0 | 470 | 14 | 456 | 150,000 | 8.2 | 0 |
| | | 12/11/63 | | | | | 700 | | |
| 0.S.-1.4 | ST JULIAN DRAIN BELOW CNR | 25/9/58 | 30.0 | 344 | 32 | 312 | 2,400 | 11.1 | 0 |
| | ARSENIC (AS) - 0.04 | | | | | | | | |
| | CYANIDE (HCN) - 0 | | | | | | | | |
| | LEAD (PB) - TRACE | | | | | | | | |
| 0.S.-1.5 | ST JULIAN DRAIN AT BLOOR STREET | 25/9/58 | 39.0 | 272 | 30 | 242 | 20,000 | 11.1 | 0 |
| | '58 '63 | 12/11/63 | 62.0 | 1,200 | 688 | 512 | 1,000 | 6.9 | |
| | ARSENIC (AS) - 0 -- | | | | | | | | |
| | CYANIDE (HCN) - 0 -- | | | | | | | | |
| | LEAD (PB) - TRACE 0.4 | | | | | | | | |
| | ETHER SOLUBLES - 86 155 | | | | | | | | |
| 0-0.4 | OSHAWA CREEK AT SIMCOE STREET SOUTH | 15/10/58 | 71.0 | 780 | 74 | 706 | 2,000 | | |
| | | 12/11/63 | 9.8 | 426 | 10 | 416 | 6,000 | | |
| 0-0.41W(N) | STORM DRAIN TO NORTH BANK | 15/10/58 | 2.7 | 158 | 6 | 152 | 2,500 | | |

| SAMPLING POINT NO | DESCRIPTION OF SAMPLING POINTS | DATE | 5-DAY BOD | SOLIDS (PPM) TOTAL | SUSP | DISS | TOTAL COLIFORM COUNT PER 100 ML | PH | CHROME AS CR |
|---|---|---|---|---|---|---|---|---|---|
| 0-1.4 | OSHAWA CREEK AT THOMAS STREET | 15/10/58 | 37.0 | 528 | 80 | 448 | 10,000 | 7.0 | 2.0 |
| | | 12/11/63 | 72.0 | 880 | 72 | 808 | 4,000 | 8.6 | 0.50 |
| | NITRATE - TRACE | | | | | | | | |
| | NITRITE - TRACE | | | | | | | | |
| | FREE WH3 AS N - 6.4 | | | | | | | | |
| | TOTAL KJELDAHL N - 13 | | | | | | | | |
| 0-1.81A | SOUTH OUTFALL FROM ROBSON-LANG | 15/10/58 | 9.0 | 380 | 56 | 324 | 100,000 | 8.0 | -- |
| | LEATHERS '63 '58 | 12/11/63 | 17.0 | 584 | 24 | 560 | 2,900,000 | 8.0 | 0.02 |
| | PHENOLS IN PPB - 10 | | | | | | | | |
| | NITRITE - 0.04 | | | | | | | | |
| | NITRATE - 0.15 | | | | | | | | |
| | ALKALINITY (CACO3) - 244 220 | | | | | | | | |
| | FREE NH3 AS N - 1.5 0.7 | | | | | | | | |
| | TOTAL KJELDAHL - 1.7 6.5 | | | | | | | | |
| 0-1.81(0) | MIDDLE OUTFALL FROM ROBSON-LANG | 15/10/58 | 362.0 | 3,020 | 260 | 2,760 | 30,000 | 7.5 | 87.0 |
| | LEATHERS '58 '63 | 12/11/63 | 880.0 | 8,124 | 571 | 7,553 | 0 | 11.7 | 1.9 |
| | NITRITE - -- TRACE | | | | | | | | |
| | NITRATE - -- TRACE | | | | | | | | |
| | ALKALINITY (CACO3) - 400 1190 | | | | | | | | |
| | FREE NH3 AS N - 16.0 82 | | | | | | | | |
| | TOTAL KJELDAHL - 176 200 | | | | | | | | |
| 0-1.81(C) | NORTH OUTFALL FROM ROBSON-LANG | 15/10/58 | 15.0 | 1,146 | 86 | 1,060 | 10,000 | 9.0 | |
| | LEATHERS '58 '63 | 12/11/63 | 16.0 | 714 | 173 | 547 | 1,390,000 | 7.2 | 0.04 |
| | PHENOLS IN PPB -- 300 | | | | | | | | |
| | ALKALINITY (CACO3) 1100 220 | | | | | | | | |
| | ABS -- 3.5 | | | | | | | | |
| | TOTAL KJELDAHL 48.0 -- | | | | | | | | |

| SAMPLING POINT NO | DESCRIPTION OF SAMPLING POINTS | DATE | 5-DAY BOD | SOLIDS (PPM) TOTAL | SUSP | DISS | TOTAL COLIFORM COUNT PER 100 ML | PH | CHROME AS CR |
|---|---|---|---|---|---|---|---|---|---|
| 0-2.1 | OSHAWA CREEK UPSTREAM OF ROBSON-LANG LEATHERS | 15/10/58 | 3.5 | 290 | 6 | 284 | 2,400 | | |
| | | 12/11/63 | 2.1 | 252 | 2 | 250 | 50 | | |
| 0-2.2W | STORM SEWER OUTFALL NEAR END OF WHITING AVENUE TO OSHAWA CREEK<br>PHENOLS IN PPB - 30<br>CYANIDE (HCN) - 0 | 12/11/63 | 2.1 | 262 | 2 | 260 | 30 | 8.1 | 0.05 |
| 0-2.3W | STORM SEWER FROM CONANT STREET TO OSHAWA CREEK<br>CYANIDE (HCN) - 0<br>COPPER (CU) - <0.05 | 12/11/63 | 1.8 | 437 | 7 | 430 | 70,000 | | 0.15 |
| 0-2.6W(W) | STORM SEWER OUTFALL AT BLOOR STREET WEST TO WEST BANK OF OSHAWA CREEK | 15/10/58 | 2.1 | 270 | 16 | 254 | 3,000 | | |
| | | 12/11/63 | | | N O | F L O W | | | |
| 0-2.6W(E) | STORM SEWER OUTFALL AT BLOOR STREET WEST TO EAST BANK OF OSHAWA CREEK | 15/10/58 | 1.5 | 286 | 12 | 274 | 4,000 | | |
| | | 12/11/63 | 1.3 | 332 | 6 | 326 | 103,000 | | |
| 0-2.7 | OSHAWA CREEK AT HIGHWAY 401 | 15/10/58 | 21.0 | 294 | 6 | 288 | 1,600 | | |
| | | 12/11/63 | 2.0 | 332 | 3 | 329 | 41,000 | | |
| OG-3.3 | GOODMAN CREEK AT NASSAU STREET | 16/10/58 | 1.8 | 250 | 12 | 238 | 10,000 | | |
| | | 12/11/63 | 3.0 | 438 | 5 | 433 | 34,000 | | |
| OG-4.7W | STORM SEWER TO EAST BANK OF GOODMAN CREEK - NORTH SIDE OF KING STREET | 16/10/58 | 1.0 | 568 | 22 | 546 | <10 | | |
| | | 12/11/63 | 82.0 | 570 | 98 | 472 | 102,000 | | |
| OG-4.7 | GOODMAN CREEK AT NORTH SIDE OF KING STREET | 16/10/58 | 1.2 | 360 | 32 | 328 | 640 | | |
| | | 12/11/63 | 1.6 | 414 | 1 | 413 | 17,000 | | |
| 0-3.4W(W) | STORM SEWER TO WEST BANK OF OSHAWA CREEK AT GIBB STREET | 16/10/58 | 54.0 | 698 | 68 | 630 | 2,000,000 | | |
| | | 12/11/63 | 18.0 | 278 | 5 | 273 | 1,890,000 | | |
| 0-3.6W | STORM SEWER TO EAST BANK OF OSHAWA CREEK NORTH SIDE OF JOHN STREET | 16/10/58 | 11.0 | 296 | 62 | 234 | 180,000 | 7.5 | |
| | | 12/11/63 | 33.0 | 592 | 8 | 584 | 16,300 | | |

| SAMPLING POINT NO | DESCRIPTION OF SAMPLING POINTS | DATE | 5-DAY BOD | SOLIDS (PPM) TOTAL | SUSP | DISS | TOTAL COLIFORM COUNT PER 100 ML | PH | CHROME AS CR |
|---|---|---|---|---|---|---|---|---|---|
| 0-3.9W | STORM SEWER OUTFALL AT KING STREET WEST TO EAST BANK OF OSHAWA CREEK | 12/11/63 | 78.0 | 768 | 25 | 743 | 33,000 | | |
| 0-3.9 | OSHAWA CREEK AT HIGHWAY 2 | 16/10/58 | 1.7 | 320 | 20 | 300 | 870 | 7.4 | 0.0 |
| | '58 '63 | 12/11/63 | 2.7 | 328 | 8 | 320 | 3,300 | | 0.0 |
| | IRON (FE) - 0.12 -- | | | | | | | | |
| | CYANIDE (HCN) - 0 0 | | | | | | | | |
| | ETHER SOLUBLES - 9.7 | | | | | | | | |
| | PHENOLS IN PPB -- 8 | | | | | | | | |
| 0-4.0 | OSHAWA CREEK SOUTH SIDE OF BOND STREET | 12/11/63 | 3.9 | 386 | 1 | 385 | 5,700 | 8.2 | |
| | IRON (FE) - 0.40 | | | | | | | | |
| | PHENOLS IN PPB - 18 | | | | | | | | |
| | ETHER SOLUBLES - TRACE | | | | | | | | |
| 0-4.0W(E) | STORM SEWER OUTFALL AT BOND STREET WEST TO EAST BANK OF OSHAWA CREEK | 16/10/58 | 17.0 | 778 | 26 | 752 | <10 | 8.4 | 0 |
| | IRON (FE) - 0.1 | | | | | | | | |
| | CYANIDE (HCN) - 0 | | | | | | | | |
| | ETHER SOLUBLES - 10.3 | | | | | | | | |
| 0-4.0W(W) | STORM SEWER OUTFALL AT BOND STREET WEST TO WEST BANK OF OSHAWA CREEK | 16/10/58 | 25.0 | 556 | 40 | 516 | 400,000 | 7.4 | 0.0 |
| | IRON (FE) - 0.8 | | | | | | | | |
| | CYANIDE (HCN) - 0 | | | | | | | | |
| | ETHER SOLUBLES - 23 | | | | | | | | |
| 0-4.0 | OSHAWA CREEK AT NORTH SIDE OF BOND STREET | 12/11/63 | 1.9 | 306 | 1 | 305 | 10,000 | 8.5 | |
| | PHENOLS IN PPB - 0 | | | | | | | | |
| 0-4.4W(E) | STORM SEWER OUTFALL AT ADELAIDE AVENUE TO EAST BANK OF OSHAWA CREEK | 16/10/58 | 2.2 | 252 | 8 | 244 | 1,500 | | |
| | | 12/11/63 | 3.1 | 482 | 1 | 481 | 22,700 | | |
| 0-4.4W(W) | STORM SEWER OUTFALL AT ADELAIDE AVENUE TO WEST BANK OF OSHAWA CREEK | 16/10/58 | 1.6 | 620 | 28 | 592 | 2,800 | | |
| | '58 | 12/11/63 | 2.0 | 878 | 40 | 838 | 1,400 | | |
| | ETHER SOLUBLES - 2 | | | | | | | | |

Table V Cont'd

| SAMPLING POINT NO | DESCRIPTION OF SAMPLING POINTS | DATE | 5-DAY BOD | SOLIDS (PPM) TOTAL | SUSP | DISS | TOTAL COLIFORM COUNT PER 100 ML | PH | CHROME AS CR |
|---|---|---|---|---|---|---|---|---|---|
| O-5.5 | OSHAWA CREEK AT ROSSLAND ROAD WEST | 20/10/58 | 1.1 | 396 | 10 | 386 | 0 | | |
| | | 12/11/63 | 2.2 | 290 | 2 | 288 | 244 | | |
| | | 13/11/63 | 1.7 | 314 | 7 | 307 | 170 | | |
| O-5.5W(E) | STORM SEWER OUTFALL AT ROSSLAND ROAD WEST TO EAST BANK OF OSHAWA CREEK | 20/10/58 | 2.0 | 548 | 6 | 542 | 0 | | |
| | | 12/11/63 | 2.3 | 528 | 10 | 518 | 900,000 | | |
| O-5.5W(W) | STORM SEWER OUTFALL AT ROSSLAND ROAD WEST TO WEST BANK OF OSHAWA CREEK | 12/11/63 | 1.5 | 612 | 20 | 592 | 290 | | |
| O-7.0 | OSHAWA CREEK AT TAUNTON ROAD | 20/10/58 | 1.1 | 260 | 4 | 256 | 0 | | |
| | | 12/11/63 | 2.0 | 292 | 8 | 284 | 300 | | |
| OE-7.9 | EAST BRANCH OF OSHAWA CREEK AT SIMCOE STREET NORTH | 20/10/58 | 1.0 | 256 | 12 | 244 | 0 | | |
| | | 12/11/63 | 2.0 | 300 | 6 | 294 | 40,000 | | |

<u>Harmony Creek (Pertinent Samples)</u> <u>City of Oshawa</u>

<u>Water Pollution Survey</u>

<u>Table VI</u>
<u>Summary: 1958 and 1963 Surveys</u>

| SAMPLING POINT NO | DESCRIPTION OF SAMPLING POINT | DATE | 5-DAY BOD | SOLIDS (PPM) TOTAL | SOLIDS (PPM) SUSP | SOLIDS (PPM) DISS | TOTAL COLIFORM COUNT PER 100 ML | PH | CHROME AS CR |
|---|---|---|---|---|---|---|---|---|---|
| H-0.0 | HARMONY CREEK AT MOUTH | 12/11/63 | 18.0 | 490 | 46 | 444 | 243,000 | | |
| H-0.4 | HARMONY CREEK NEAR LAKE ONTARIO DOWN-STREAM FROM STP OUTFALL | 23/9/58 | 33.0 | 462 | 54 | 408 | 83,000 | | |
| H-0.9T | MUNICIPAL SEWAGE TREATMENT PLANT OUTFALL | 23/9/58<br>12/11/63 | 41.0<br>54.0 | 408<br>520 | 16<br>34 | 392<br>486 | 500,000<br>257,000 | | |
| HF-1.5 | FAREWELL CREEK AT HIGHWAY 401 | 23/9/58<br>12/11/63 | 0.4<br>2.3 | 228<br>306 | 10<br>1 | 218<br>305 | 200<br>193 | | |
| HF-2.5 | FAREWELL CREEK AT TOWNLINE ROAD SOUTH | 12/11/63 | 3.8 | 302 | 1 | 301 | 73 | | |
| HF-3.7 | FAREWELL CREEK AT HIGHWAY 2 | 23/9/58 | 0.9 | 278 | 24 | 254 | 40 | | |
| HD-1.95 | DEAN AVENUE DRAINAGE COURSE AT BLOOR STREET EAST '58 '63<br>ARSENIC (AS) - 0.06 --<br>CYANIDE (HCN) - TRACE --<br>PHENOL IN PPB - 20 0 | 25/9/58<br>12/11/63 | 47.0<br>3.4 | 400<br>346 | 38<br>1 | 362<br>345 | 300<br>19,800 | 6.5<br>7.9 | 9.5<br>0.0 |
| HD-2.05 | DEAN AVENUE DRAINAGE COURSE AT FAREWELL STREET<br>ARSENIC (AS) - 0.0<br>CYANIDE (HCN) - 0.0<br>PHENOL IN PPB - 18 | 25/9/58 | 6.0 | 380 | 52 | 328 | 300 | 6.4 | 2.0 |
| HD-2.30W | STORM SEWER OUTFALL AT TENNYSON AVENUE<br>ARSENIC (AS) - 0.0<br>CYANIDE (HCN) - 0<br>PHENOL IN PPB - 70 | 25/9/58 | 13.0 | 464 | 68 | 396 | <100 | 6.8 | 6.0 |

## Table VI Cont'd



| SAMPLING POINT NO | DESCRIPTION OF SAMPLING POINT | DATE | 5-DAY BOD | SOLIDS (PPM) TOTAL | SUSP | DISS | TOTAL COLIFORM COUNT PER 100 ML | PH | CHROME AS CR |
|---|---|---|---|---|---|---|---|---|---|
| H-1.7 | HARMONY CREEK AT HIGHWAY 401 | 23/9/58 | 1.7 | 504 | 10 | 494 | 400 | | |
| | | 12/11/63 | 2.5 | 400 | 8 | 392 | 1,490 | | |
| H-3.18 | HARMONY CREEK (MAIN BR) BELOW CONFLUENCE OF WEST BRANCH OF HARMONY CREEK | 23/9/58 | 1.2 | 510 | 14 | 496 | 300 | | |
| | | 12/11/63 | 2.4 | 490 | 4 | 486 | 2,600 | | |
| H-5.14 | HARMONY CREEK (MAIN BR) AT TOWNLINE ROAD NORTH | 23/9/58 | 0.4 | 428 | 44 | 384 | 490 | | |
| | | 12/11/63 | 1.7 | 432 | 1 | 431 | 2,600 | | |
| HW-3.98 | HARMONY CREEK (WEST BR) AT KING STREET EAST | 23/9/58 | 1.8 | 480 | 46 | 434 | 300 | | |
| | | 12/11/63 | 2.1 | 540 | 13 | 527 | 2,900 | | |
| H-4.6DS | SEPTIC TANK EFFLUENT FROM MARACLE PRESS LIMITED TO FLOOD PLAIN OF HARMONY CREEK | 23/9/58 | 50.0 | 2,200 | 756 | 1,444 | 2,300,000 | | |
| H-4.7W | STORM DRAIN FROM MARACLE PRESS LIMITED TO HARMONY CREEK | 23/9/58 | 12.0 | 282 | 24 | 258 | <10 | | |
| H-4.7W1 | DRAIN FROM MARACLE PRESS LIMITED TO HARMONY CREEK (PROCESS WASTE) CYANIDE (HCN) - 3.7 PHENOL IN PPB - TRACE | 23/9/58 | 95.0 | 1,928 | 636 | 1,292 | <10 | 7.4 | 0 |
| HW-5.52 | HARMONY CREEK (WEST BR) AT ROSSLAND ROAD EAST | 24/9/58 | 1.9 | 408 | 46 | 362 | 300 | | |
| | | 12/11/63 | 1.9 | 357 | 1 | 356 | 2,500 | | |
| HW-5.01 | HARMONY CREEK (WEST BR) AT HARMONY ROAD | 24/9/58 | 2.0 | 356 | 30 | 326 | 140 | | |
| | | 28/10/58 | 1.3 | 272 | 8 | 264 | <10 | | |
| HW-5.8D | DRAINAGE TO HARMONY CREEK (WEST BR) FROM SITE OF INDUSTRIAL GARBAGE AND DISPOSAL LIMITED ETHER SOLUBLES - 11.3 | 28/10/58 | 2.4 | 476 | 54 | 422 | <10 | | |

| SAMPLING POINT NO | DESCRIPTION OF SAMPLING POINT | DATE | 5-DAY BOD | SOLIDS (PPM) TOTAL | SUSP | DISS | TOTAL COLIFORM COUNT PER 100 ML | PH | CHROME AS CR |
|---|---|---|---|---|---|---|---|---|---|
| HW-6.00 | HARMONY CREEK (WEST BR) AT LITTLE BUCKAROO RANCH | 28/10/58 | 2.4 | 316 | 10 | 306 | <10 | | |
| HWO-4.5 | HARMONY CREEK (NORTHWEST BR) AT WILSON ROAD NORTH NEAR COLBORNE STREET | 24/9/58 | 4.8 | 600 | 38 | 562 | 60 | | |
| | | 12/11/63 | 2.1 | 614 | 2 | 612 | 1,100 | | |
| HWO-4.5W(W) | STORM SEWER OUTFALL TO SOUTH BANK OF HARMONY CREEK (NORTHWEST BR) WEST SIDE | 24/9/58 | 0.8 | 626 | 40 | 586 | <10 | | |
| HWO-4.9D | STORM DRAIN TO HARMONY CREEK (NORTHWEST BR) OPPOSITE IDEAL DAIRY - RITSON ROAD NORTH | 24/9/58 | 3.5 | 490 | 38 | 452 | 1,000 | | |
| | | 12/11/63 | 2.3 | 406 | 3 | 403 | 2,100 | | |
| HWO-5.75 | HARMONY CREEK (NORTHWEST BR) AT RITSON ROAD NORTH | 24/9/58 | 1.5 | 440 | 14 | 426 | 740 | | |
| | | 12/11/63 | 1.5 | 446 | 6 | 440 | 390 | | |
| HWO-6.47W | STORM SEWER OUTFALL NORTHEAST OF ROBERT STREET TO HARMONY CREEK (NORTHWEST BR) | 24/9/58 | 3.1 | 738 | 2 | 736 | 62,000 | | |
| | | 12/11/63 | 6.4 | 412 | 2 | 410 | 7,000 | | |
| HWO-6.91 | HARMONY CREEK (NORTHWEST BR) NEAR NONQUON ROAD | 24/9/58 | 10.0 | 986 | 178 | 808 | 80 | | |
| | | 12/11/63 | 1.4 | 726 | 11 | 715 | 90 | | |
| HWO-6.91W | STORM SEWER OUTFALL NEAR NONQUON ROAD TO HARMONY CREEK (NORTHWEST BR) | 12/11/58 | 2.4 | 488 | 42 | 446 | <10 | | |
| | | 12/11/63 | 9.0 | 750 | 86 | 664 | 3,100 | | |

APPENDIX IV

City of Oshawa

Water Pollution Survey

1970

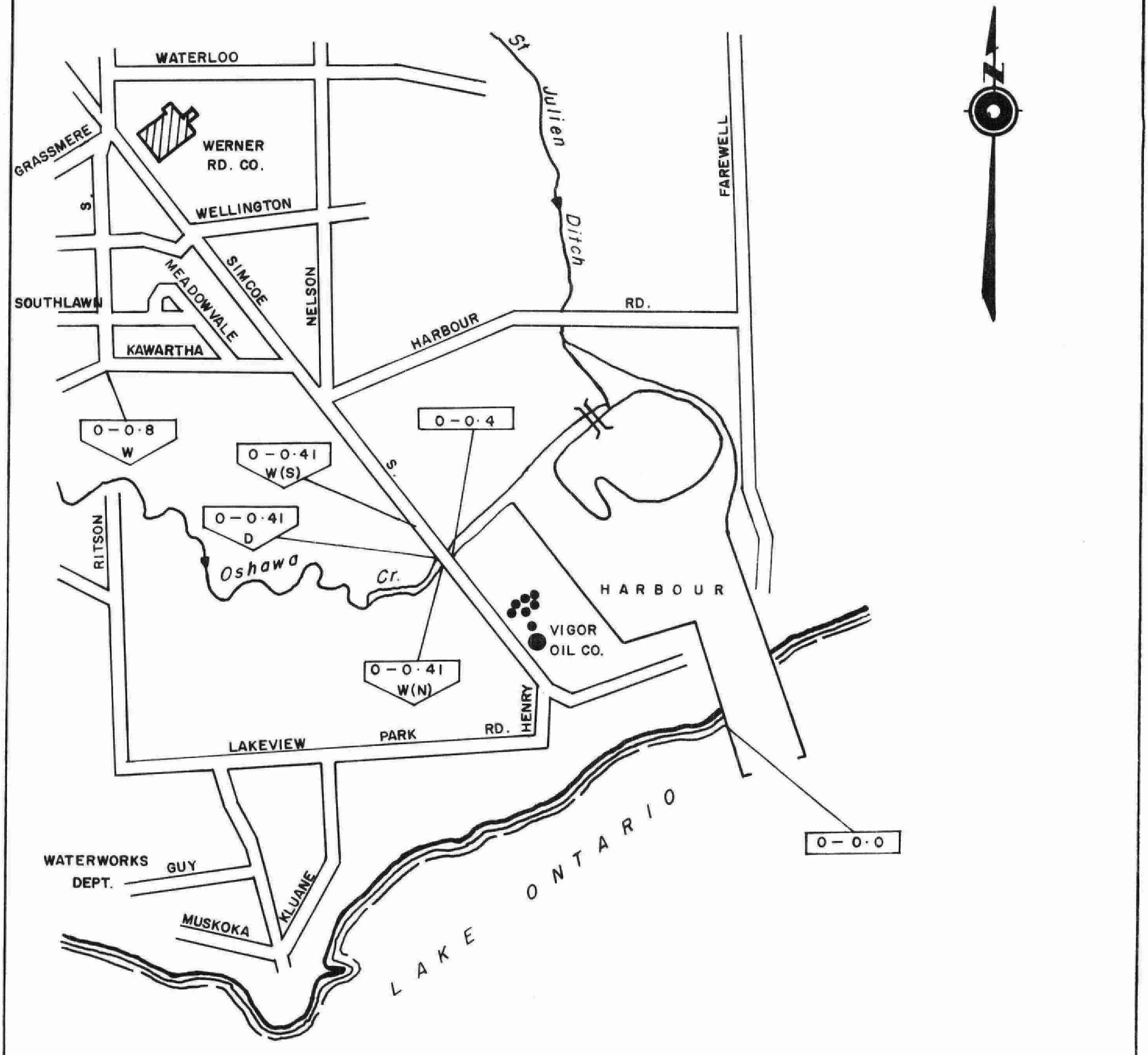
Maps

of

Oshawa Creek

Includes: Main Branch

East Branch




## LEGEND

0 – 0·4 – STREAM SAMPLING POINT SHOWING MILEAGE

0 – 0·8 W – OUTFALL SHOWING STREAM AND MILEAGE – TYPE OF OUTFALL

W – STORM SEWER

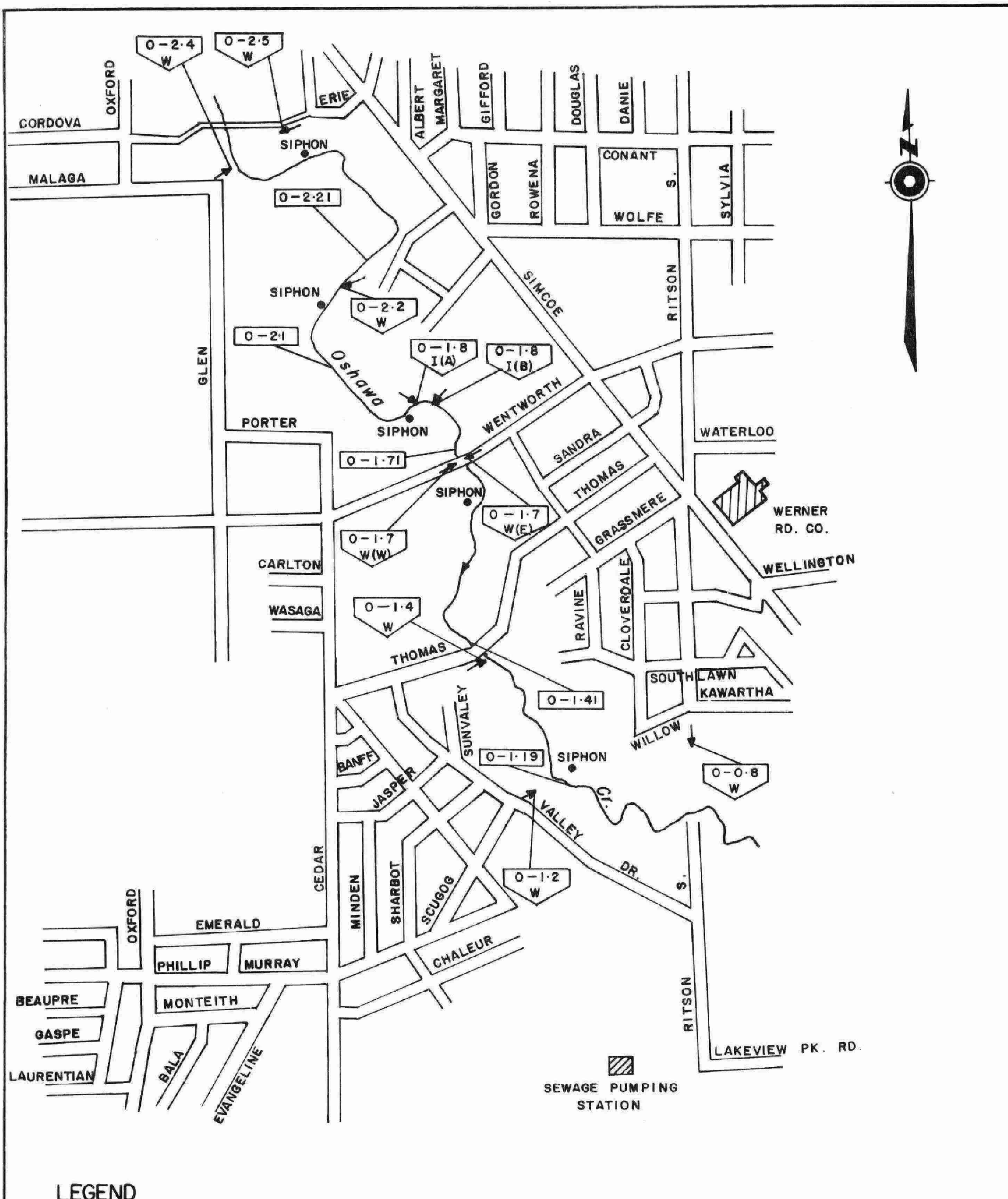
D – DRAINAGE DITCH

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
OSHAWA CREEK
Nº 1

SCALE : 1050 0 1050 FT.

| | |
|---|---|
| DRAWN BY: L.L. BROOME | DATE: SEPTEMBER 1970 |
| CHECKED BY: J.C. | DRAWING Nº: 70-147-DE |




## LEGEND

0-1·41 – STREAM SAMPLING POINT SHOWING MILEAGE

0-1·8 I(A) – OUTFALL SHOWING STREAM AND MILEAGE – TYPE OF OUTFALL

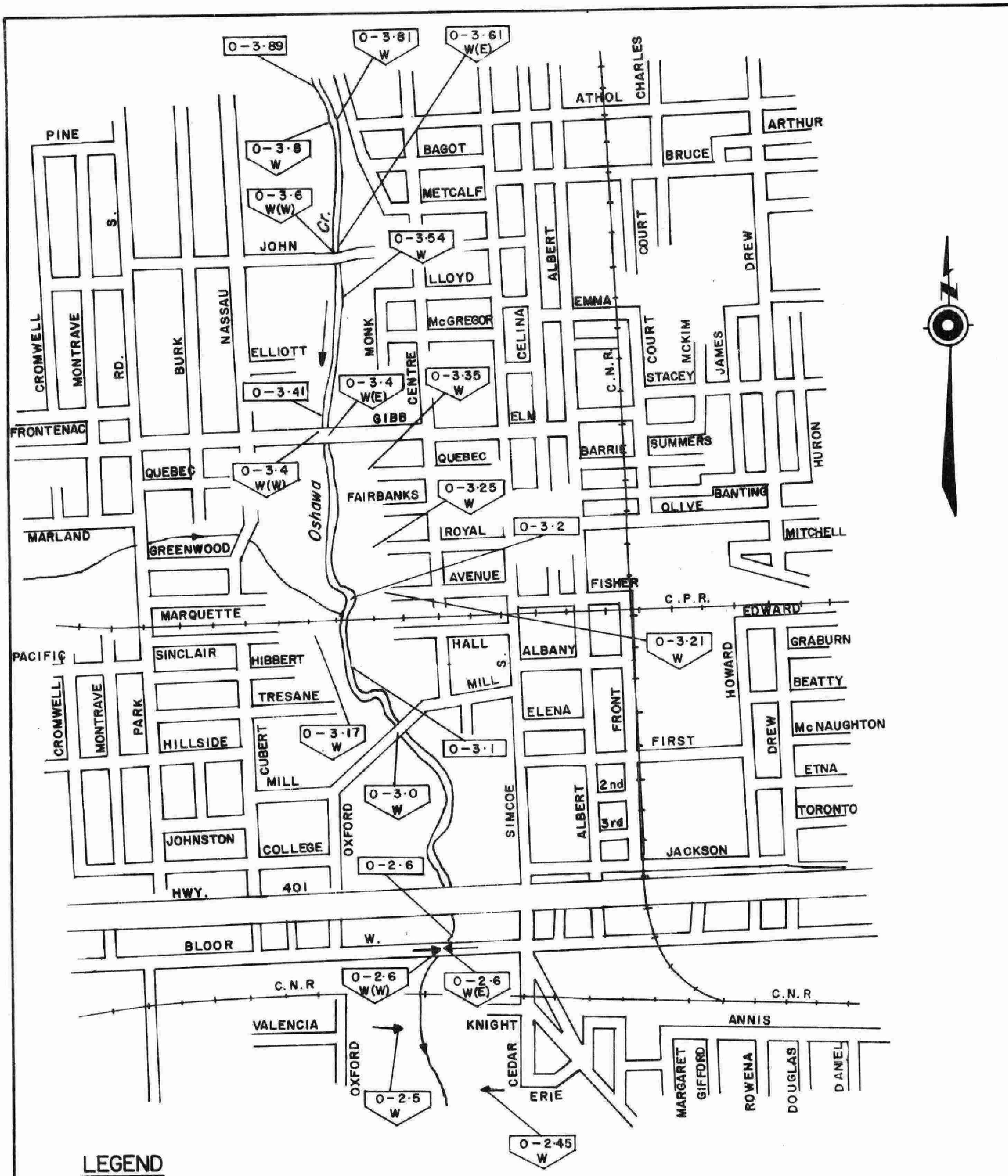
I – INDUSTRIAL SEWER

W – STORM SEWER

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
OSHAWA CREEK
Nº 2

| | |
|---|---|
| SCALE: 1050 0 1050 FT. | |
| DRAWN BY: L.L. BROOME | DATE: OCTOBER, 1970 |
| CHECKED BY: J.C. | DRAWING Nº: 70-154-DE |




## LEGEND

0-2.6 – STREAM SAMPLING POINT SHOWING MILEAGE

0-3.0 W – OUTFALL SHOWING STREAM AND MILEAGE – TYPE OF OUTFALL

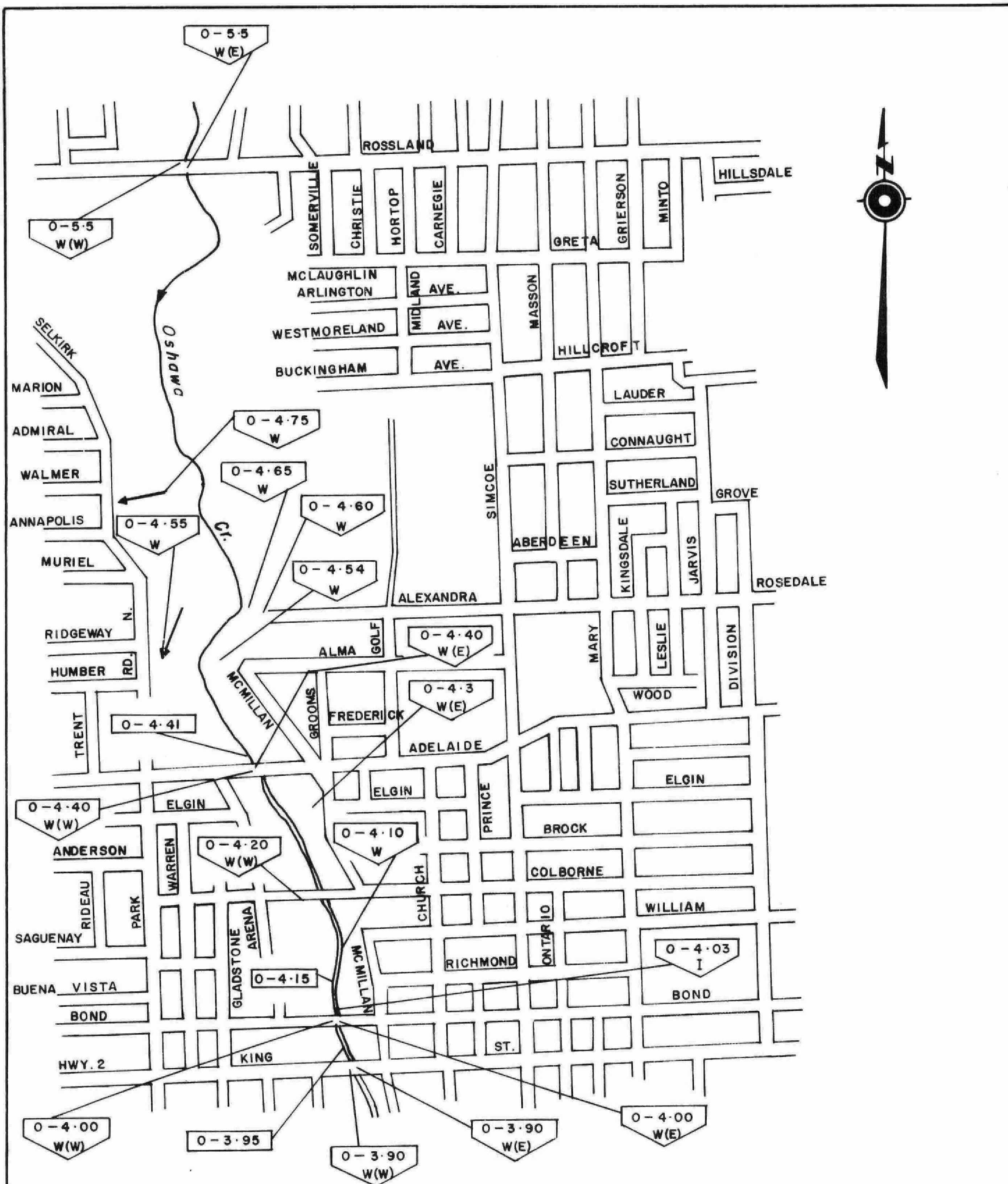
W – STORM SEWER

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
OSHAWA CREEK
Nº 3

SCALE: 1050 0 1050 FT.

| | |
|---|---|
| DRAWN BY: L.L. BROOME | DATE: OCTOBER 1970 |
| CHECKED BY: J.C. | DRAWING Nº: 70-153-DE |




## LEGEND

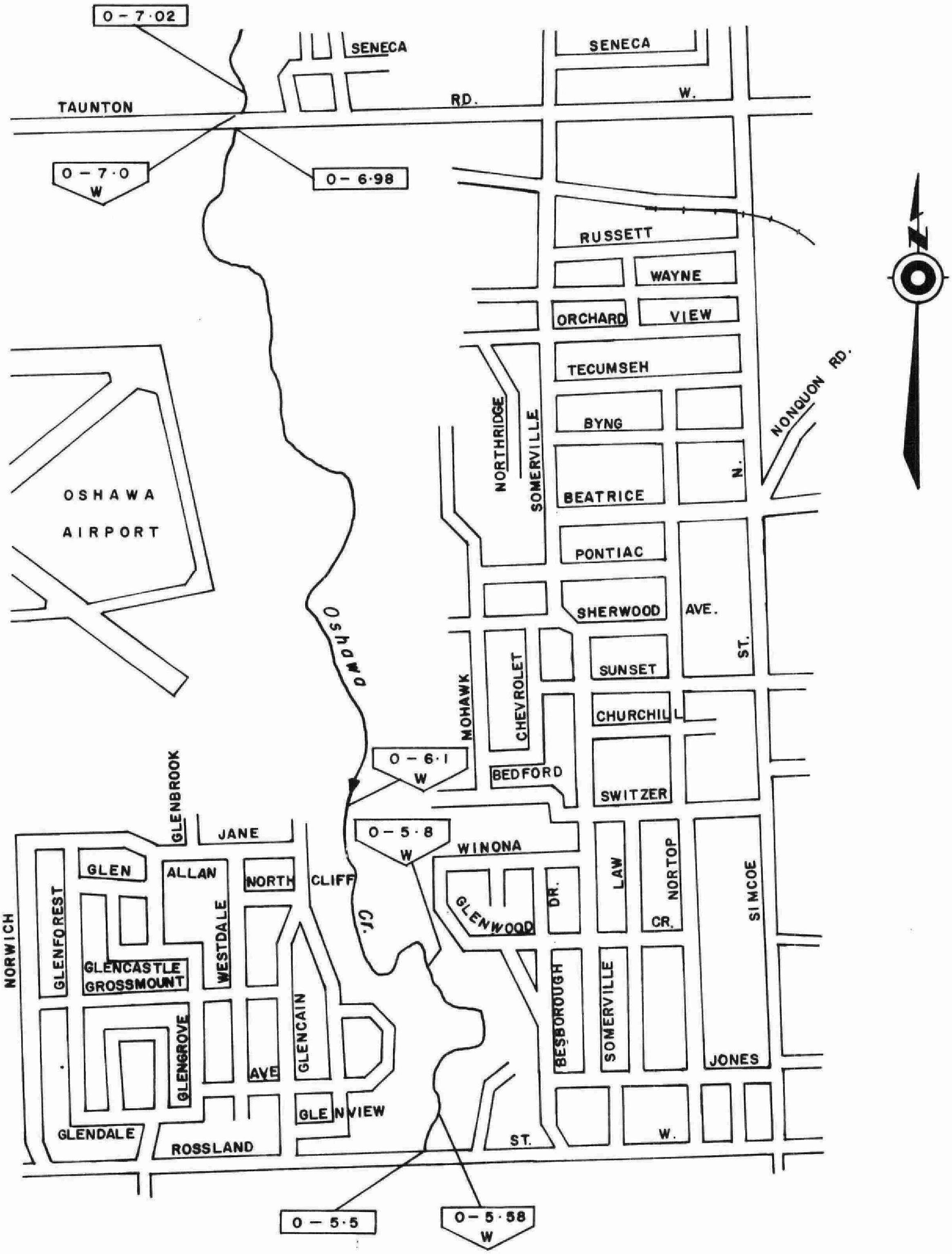
0-3.95 – STREAM SAMPLING POINT SHOWING MILEAGE

0-4.03 I – OUTFALL SHOWING STREAM AND MILEAGE
– TYPE OF OUTFALL

I – INDUSTRIAL SEWER

W – STORM SEWER

| ONTARIO WATER RESOURCES COMMISSION | |
|---|---|
| CITY OF OSHAWA<br>OSHAWA CREEK<br>Nº 4 | |
| SCALE: 1050 0 1050 FT. | |
| DRAWN BY: L. L. BROOME | DATE: SEPTEMBER 1970 |
| CHECKED BY: J.C. | DRAWING Nº: 70-151-DE |



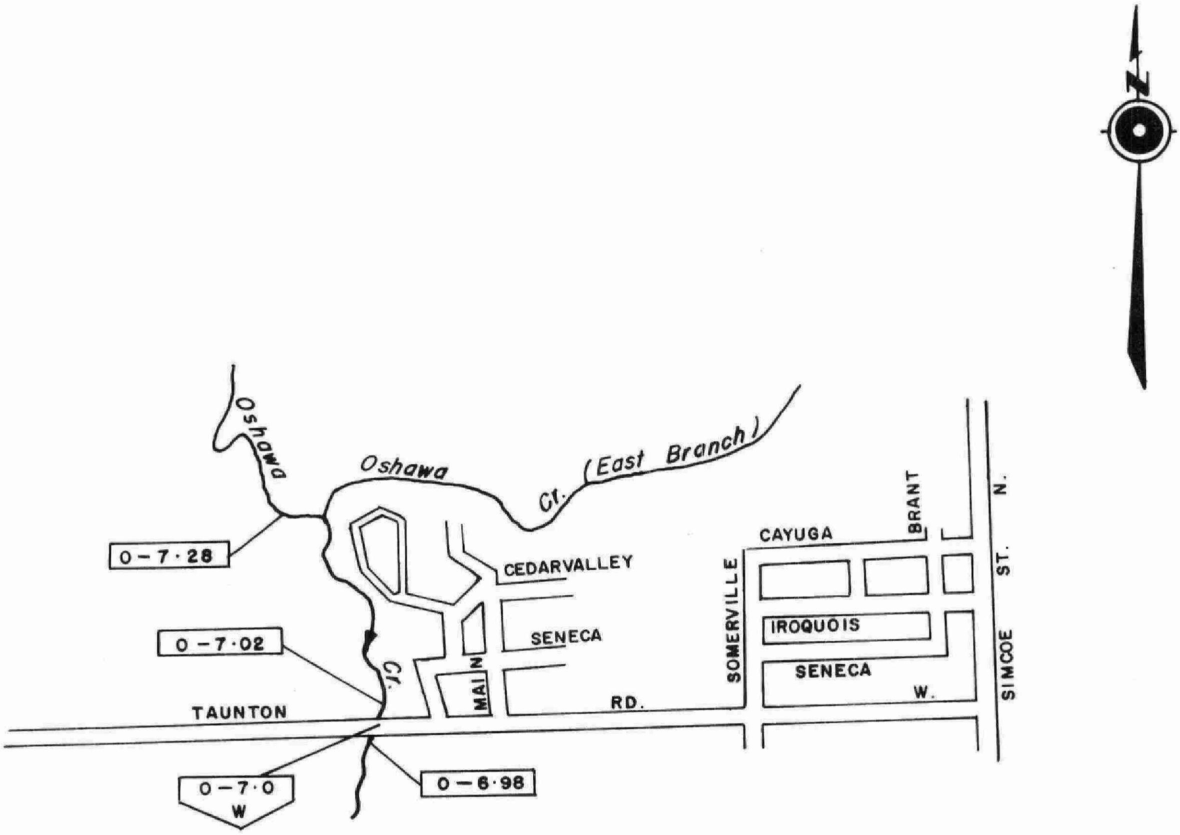

## LEGEND

0 - 6·98 – STREAM SAMPLING POINT SHOWING MILEAGE

0 — 5·58 W – OUTFALL SHOWING STREAM AND MILEAGE
– TYPE OF OUTFALL

W – STORM SEWER

| | |
|---|---|
| ONTARIO WATER RESOURCES COMMISSION | |
| CITY OF OSHAWA<br>OSHAWA CREEK<br>Nº 5 | |
| SCALE: 1050 0 1050 FT. | |
| DRAWN BY: L.L. BROOME | DATE: SEPT, 1970 |
| CHECKED BY: J. C. | DRAWING Nº: 70-139-DE |



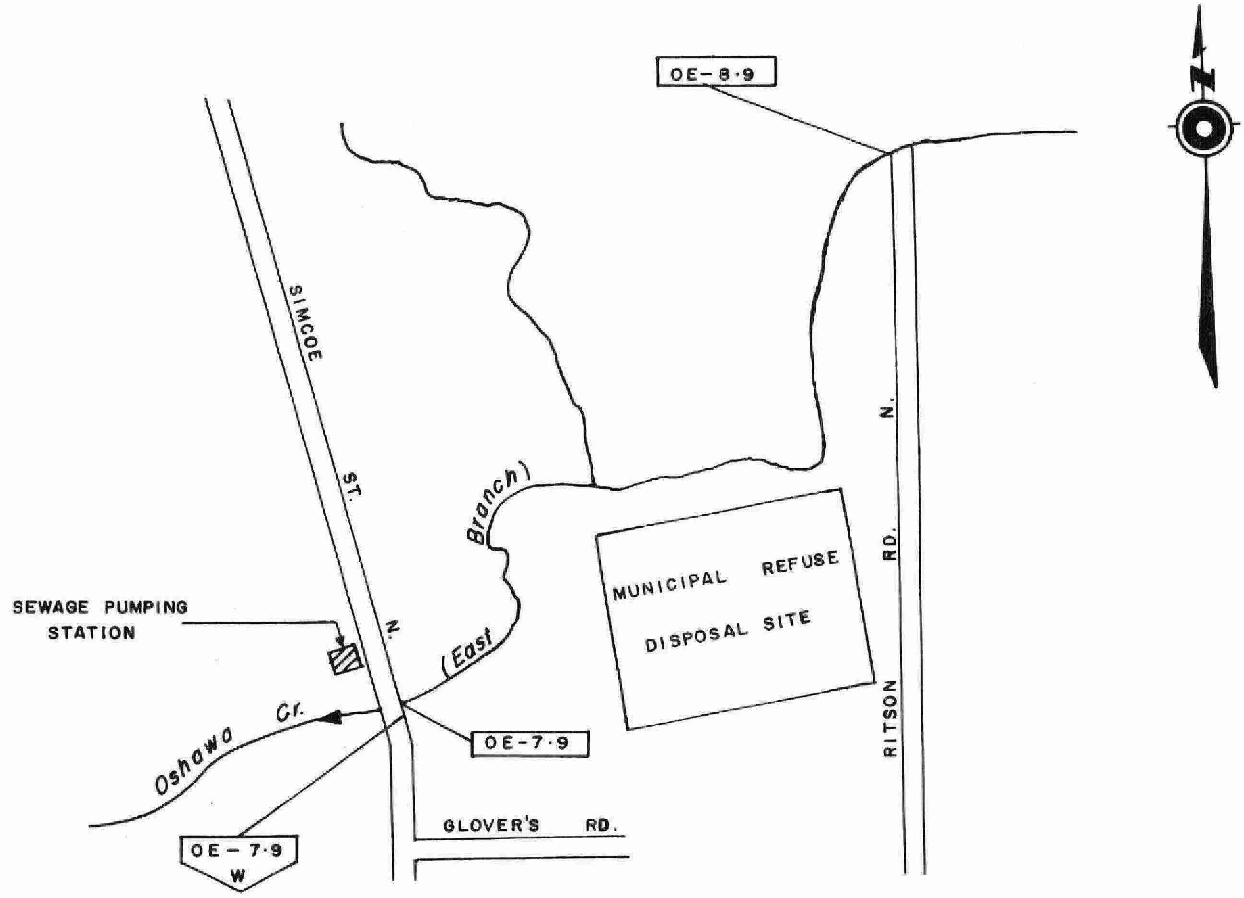

## LEGEND

0-6·08 – STREAM SAMPLING POINT SHOWING MILEAGE

0-7·0 W – OUTFALL SHOWING STREAM AND MILEAGE – TYPE OF OUTFALL

W – STORM SEWER

| | |
|---|---|
| ONTARIO WATER RESOURCES COMMISSION | |
| CITY OF OSHAWA<br>OSHAWA CREEK<br>Nº 6 | |
| SCALE : 1050 0 1050 FT. | |
| DRAWN BY : L.L. BROOME | DATE : SEPT., 1970 |
| CHECKED BY : J.C. | DRAWING Nº : 70-140-DE |




## LEGEND

OE-7·9 - STREAM SAMPLING POINT SHOWING MILEAGE

OE-7·9 W - OUTFALL SHOWING STREAM AND MILEAGE
- TYPE OF OUTFALL

W - STORM SEWER

| ONTARIO WATER RESOURCES COMMISSION | |
|---|---|
| CITY OF OSHAWA<br>OSHAWA CREEK (EAST BRANCH)<br>Nº 7 | |
| SCALE : 1050 0 1050 FT. | |
| DRAWN BY : L.L. BROOME | DATE : SEPT., 1970 |
| CHECKED BY : J.C. | DRAWING Nº : 70-141-DE |

APPENDIX V

City of Oshawa

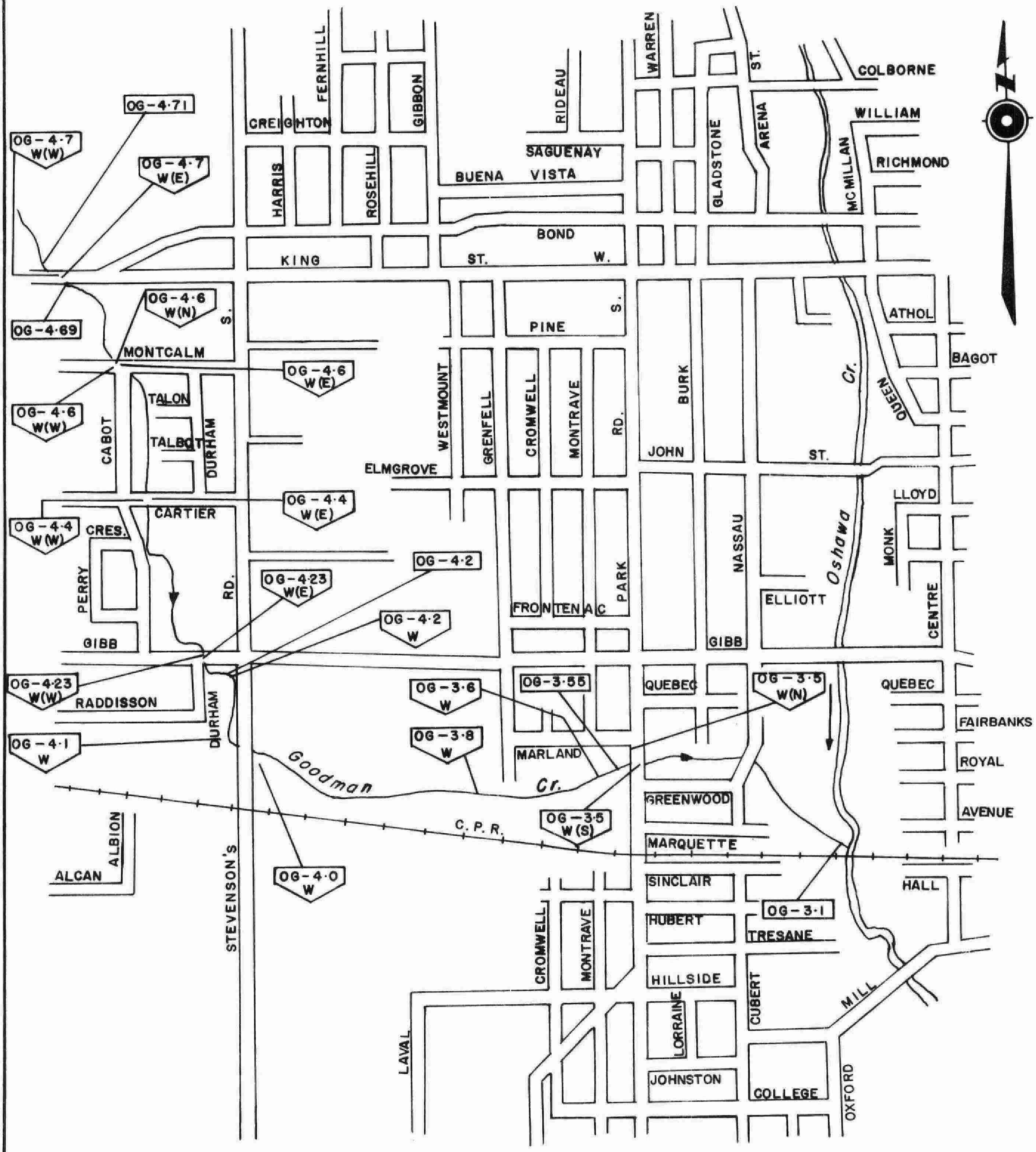
Water Pollution Survey

1970

Maps

of

Goodman Creek



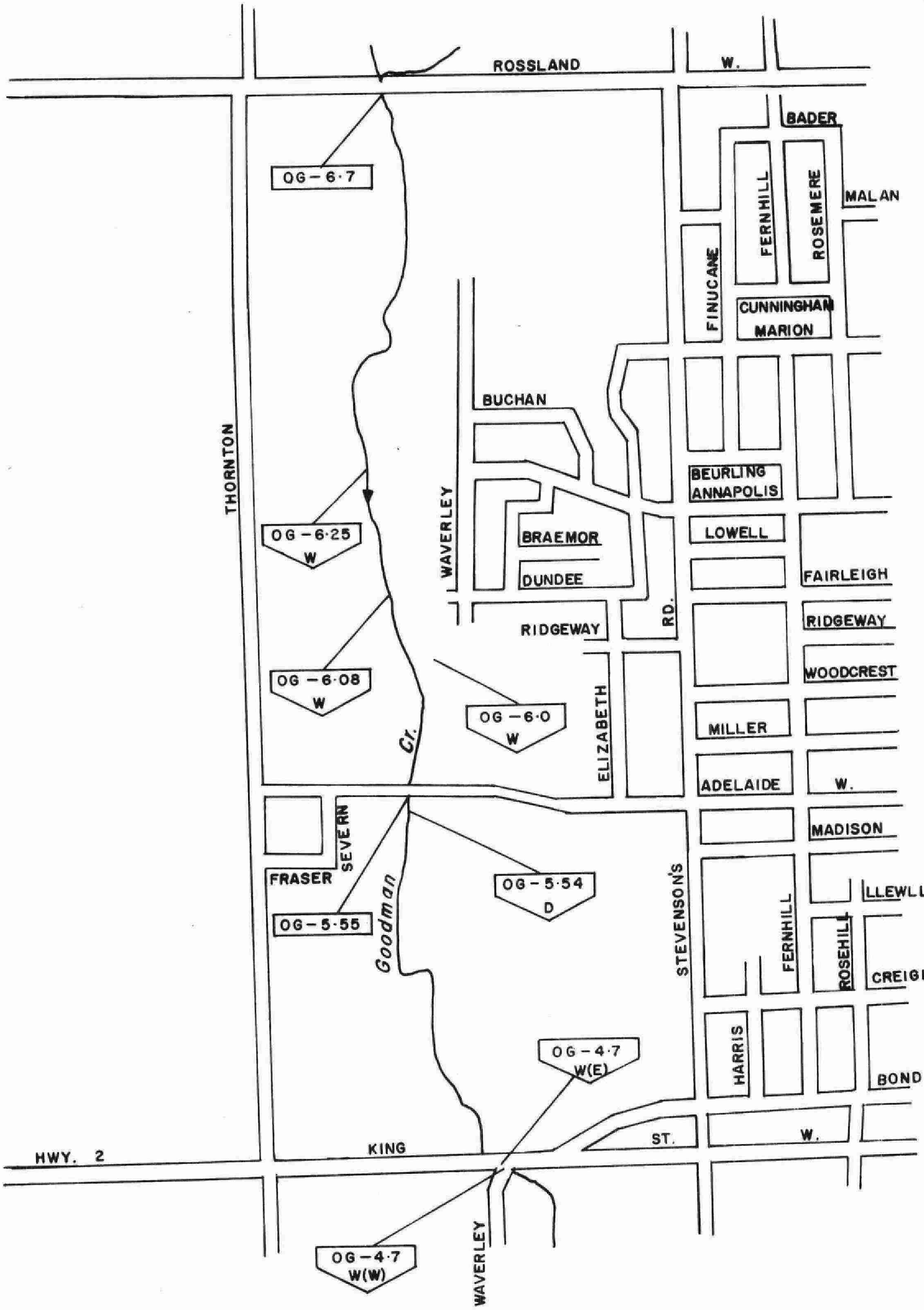

## LEGEND

OG-4·2 – STREAM SAMPLING POINT SHOWING MILEAGE

OG-4·0 W – OUTFALL SHOWING STREAM AND MILEAGE
– TYPE OF OUTFALL

W – STORM SEWER

| | |
|---|---|
| ONTARIO WATER RESOURCES COMMISSION | |
| CITY OF OSHAWA<br>GOODMAN CREEK<br>Nº: 1 | |
| SCALE: 1050 0 1050 FT. | |
| DRAWN BY: L.L. BROOME | DATE: OCTOBER, 1970 |
| CHECKED BY: J.C. | DRAWING Nº: 70-167-DE |




## LEGEND

OG – 5·55 — STREAM SAMPLING POINT SHOWING MILEAGE

OG – 5·54 D — OUTFALL SHOWING STREAM AND MILEAGE
— TYPE OF OUTFALL

D — DRAINAGE DITCH

W — STORM SEWER

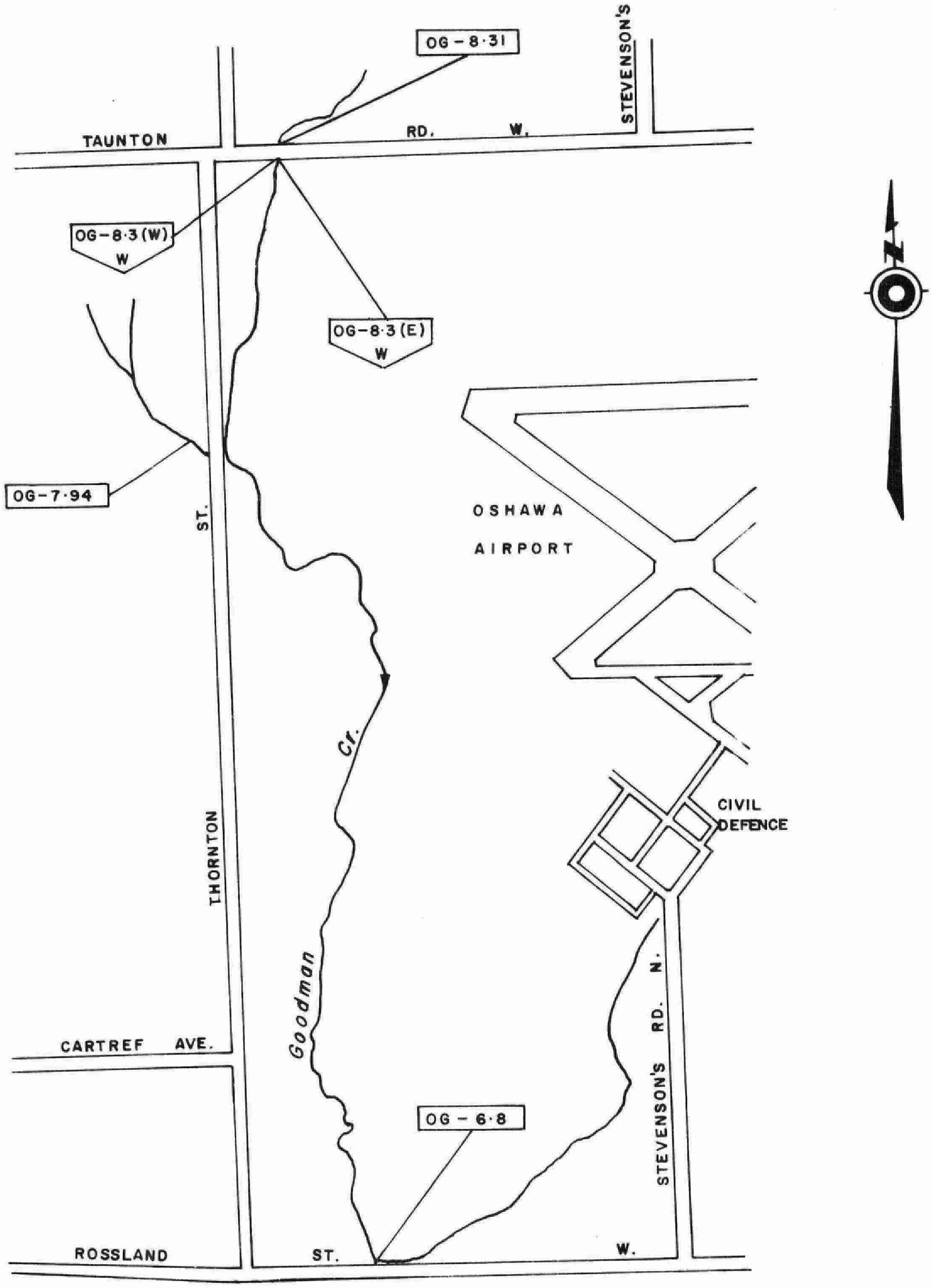
ONTARIO WATER RESOURCES COMMISSION

# CITY OF OSHAWA
## GOODMAN CREEK
## Nº 2

SCALE : 1050 0 1050 FT.

DRAWN BY : L.L. BROOME | DATE: OCTOBER 1970

CHECKED BY : J.C. | DRAWING Nº : 70-152-DE




## LEGEND

| OG-8·31 | — STREAM SAMPLING POINT SHOWING MILEAGE |
|---|---|
| OG-8·3(W) W | — OUTFALL SHOWING STREAM AND MILEAGE<br>— TYPE OF OUTFALL |

W — STORM SEWER

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
GOODMAN CREEK
Nº 3

SCALE: 1050 0 1050 FT.

| | |
|---|---|
| DRAWN BY: L. L. BROOME | DATE: SEPT, 1970 |
| CHECKED BY: J.C. | DRAWING Nº 70-138-DE |

APPENDIX VI

City of Oshawa

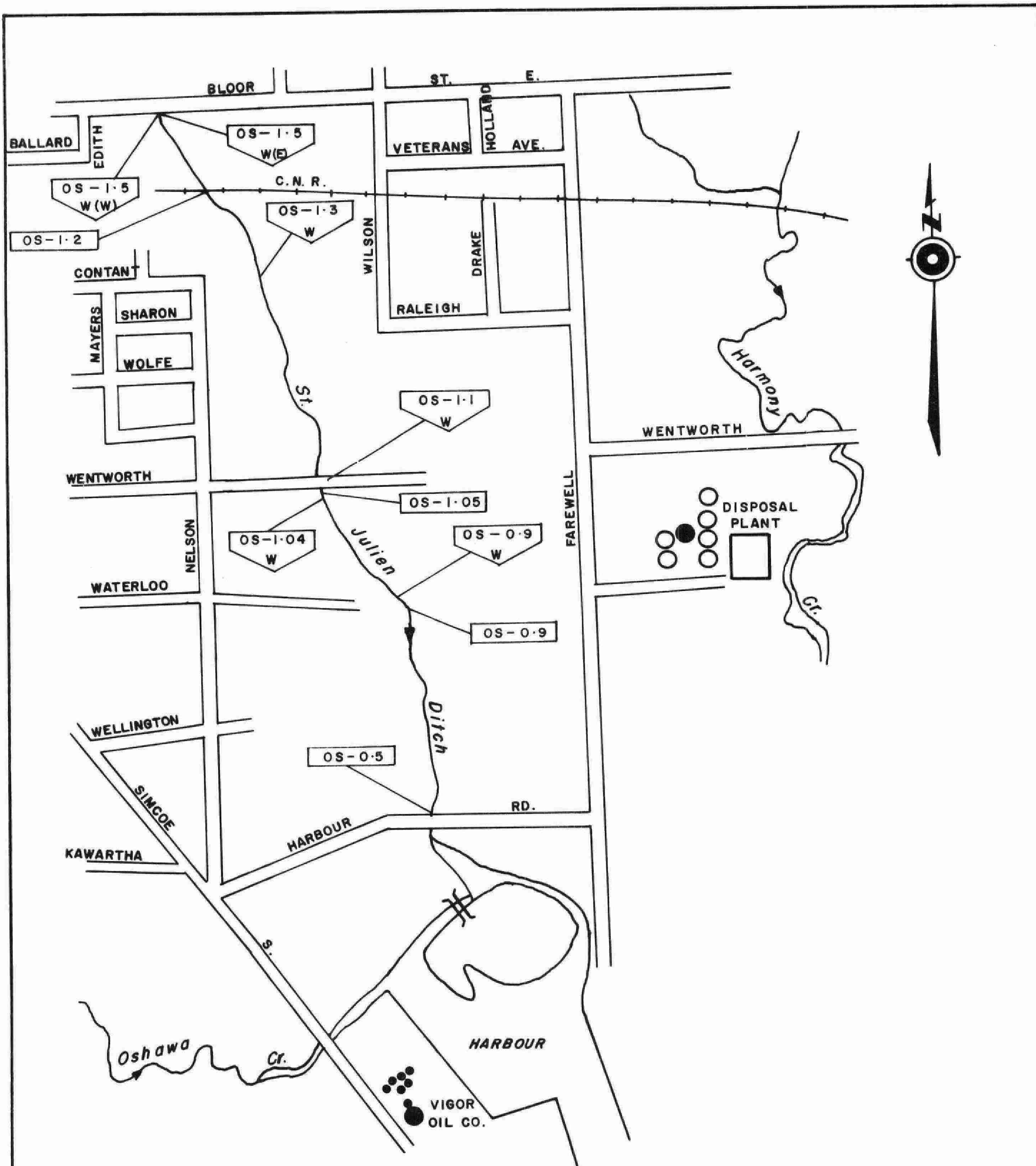
Water Pollution Survey

1970

Map

of

St. Julien Drain




## LEGEND

OS-0·5 — STREAM SAMPLING POINT SHOWING MILEAGE

OS-1·04 W — OUTFALL SHOWING STEAM AND MILEAGE TYPE OUTFALL

W — STORM SEWER

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
ST. JULIEN DRAIN

| | |
|---|---|
| SCALE: 1050 0 1050 FT. | |
| DRAWN BY: L.L. BROOME | DATE: SEPTEMBER 1970 |
| CHECKED BY: J.C. | DRAWING Nº: 70-149-DE |

# APPENDIX VII

City of Oshawa

Water Pollution Survey

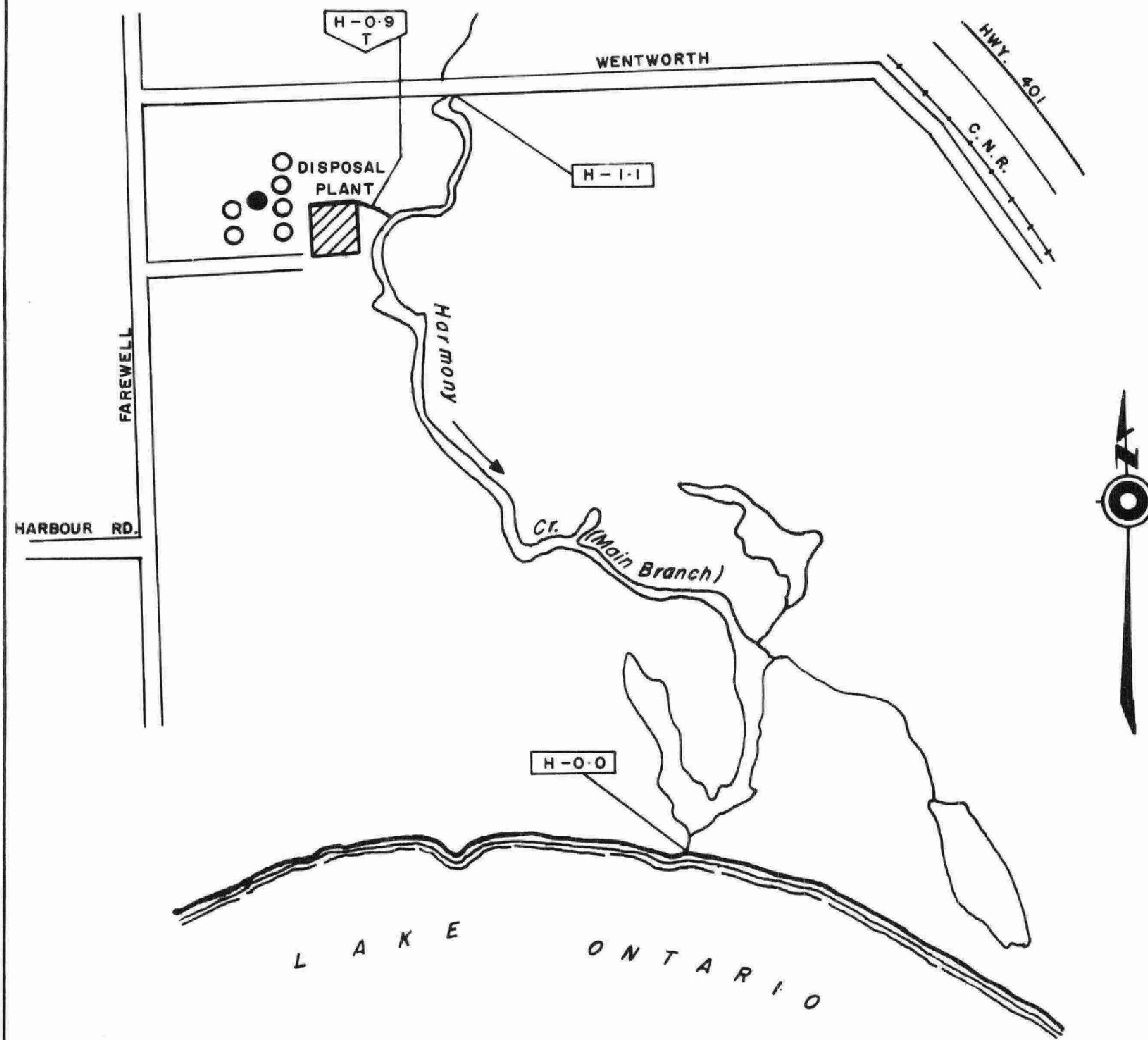
1970

Maps

of

Harmony Creek

Includes: Main Branch
Dean Avenue Drain
West Branch
Northwest Branch




**LEGEND**

H-1·1 — STREAM SAMPLING POINT SHOWING MILEAGE

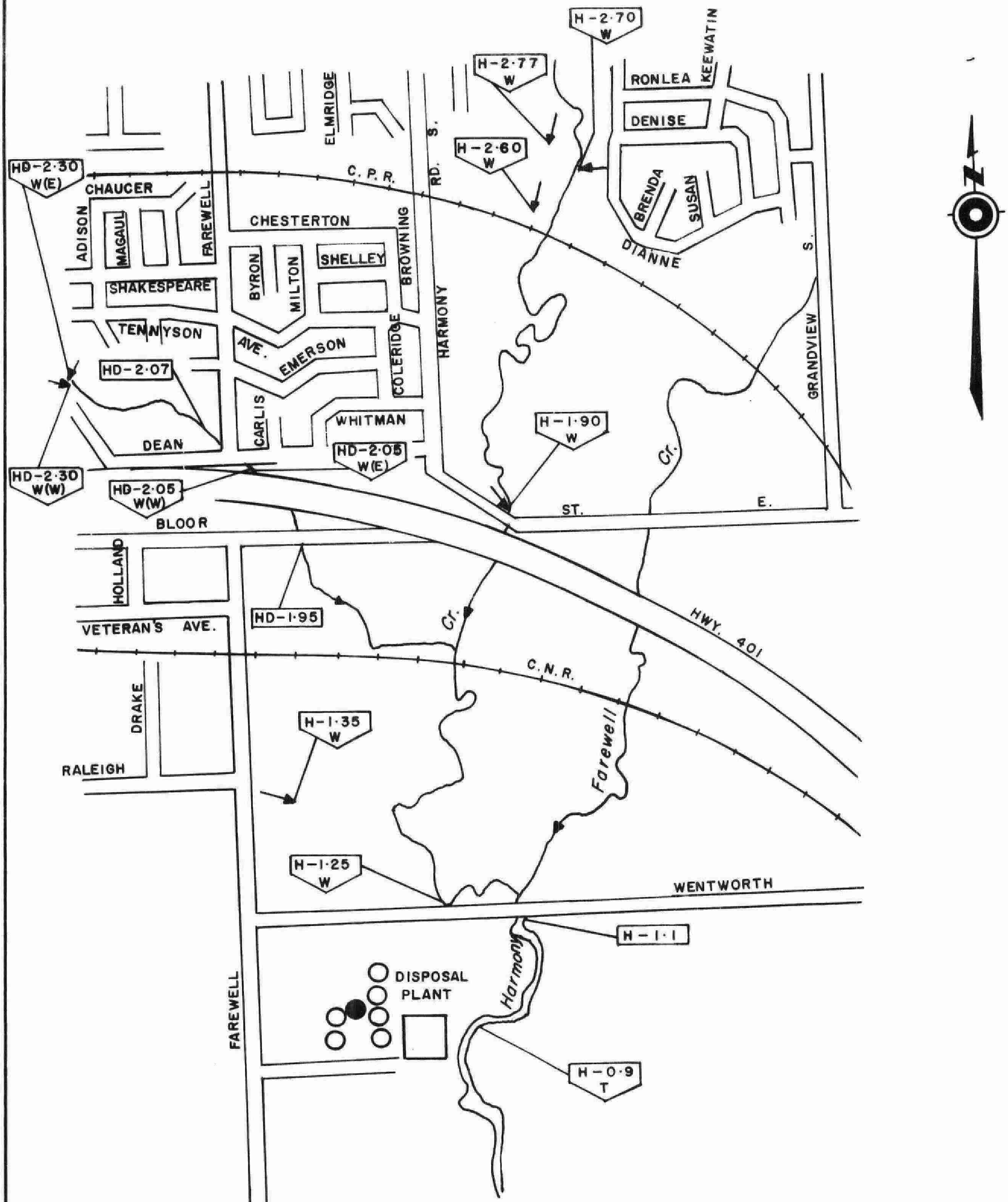
H-0·9 / T — OUTFALL SHOWING STREAM AND MILEAGE — TYPE OF OUTFALL

T — TREATMENT PLANT EFFLUENT

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
HARMONY CREEK
(MAIN BRANCH)
Nº: 1

| | |
|---|---|
| SCALE: 1050 0 1050 FT. | |
| DRAWN BY: L.L.BROOME | DATE: SEPTEMBER 1970 |
| CHECKED BY: J.C. | DRAWING Nº: 70-146-DE |




## LEGEND

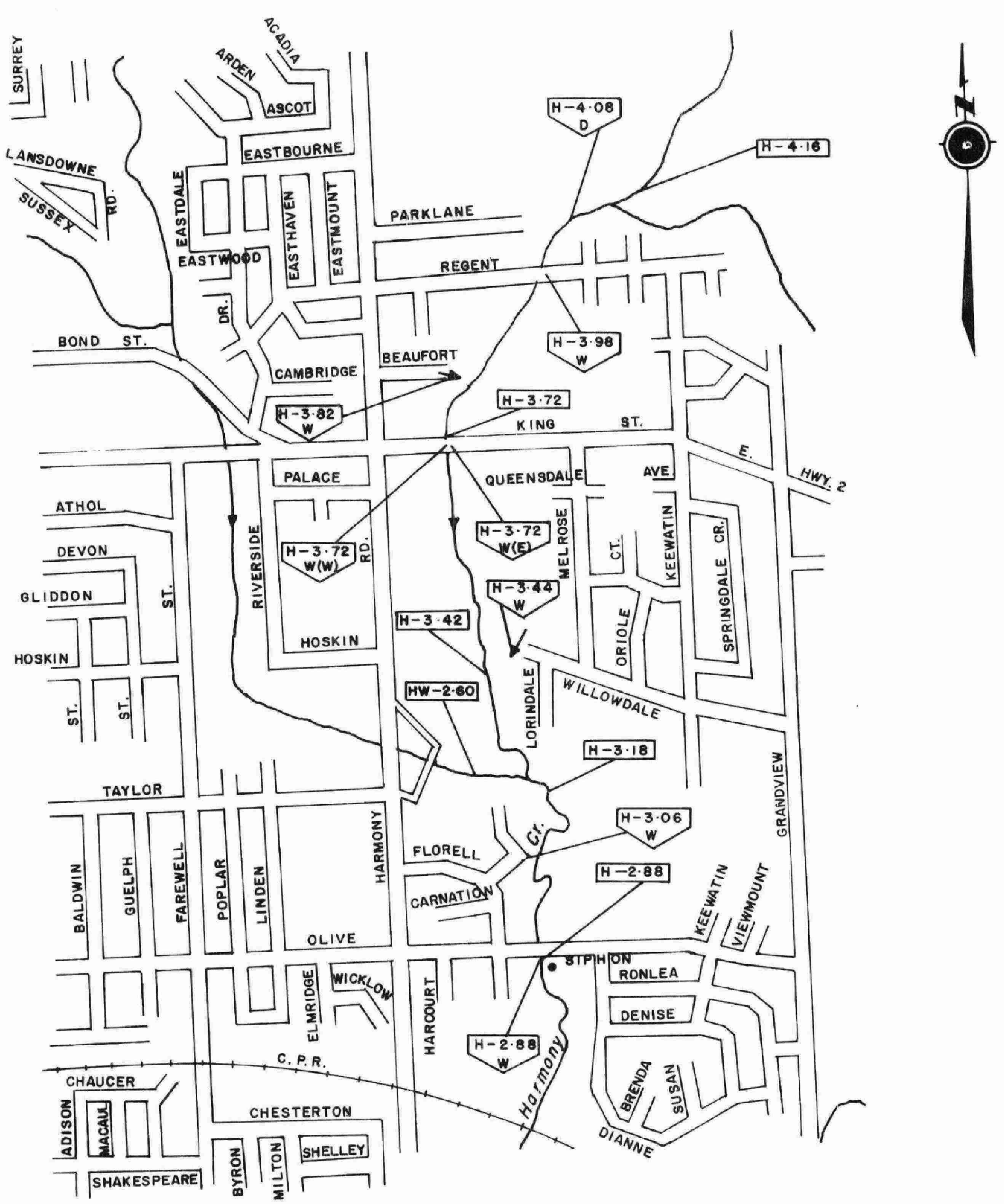
H-1·1 — STREAM SAMPLING POINT SHOWING MILEAGE

H-0·9 T — OUTFALL SHOWING STREAM AND MILEAGE
— TYPE OF OUTFALL

T — TREATMENT PLANT EFFLUENT

W — STORM SEWER

| ONTARIO WATER RESOURCES COMMISSION | |
|---|---|
| CITY OF OSHAWA<br>HARMONY CREEK<br>(MAIN BRANCH)<br>№ : 2 | |
| SCALE : 1050 0 1050 FT. | |
| DRAWN BY : L.L. BROOME | DATE : SEPTEMBER, 1970 |
| CHECKED BY : J.C. | DRAWING № : 70-148-DE |




## LEGEND

H-2·88 — STREAM SAMPLING POINT SHOWING MILEAGE

H-4·08 D — OUTFALL SHOWING STREAM AND MILEAGE
— TYPE OF OUTFALL

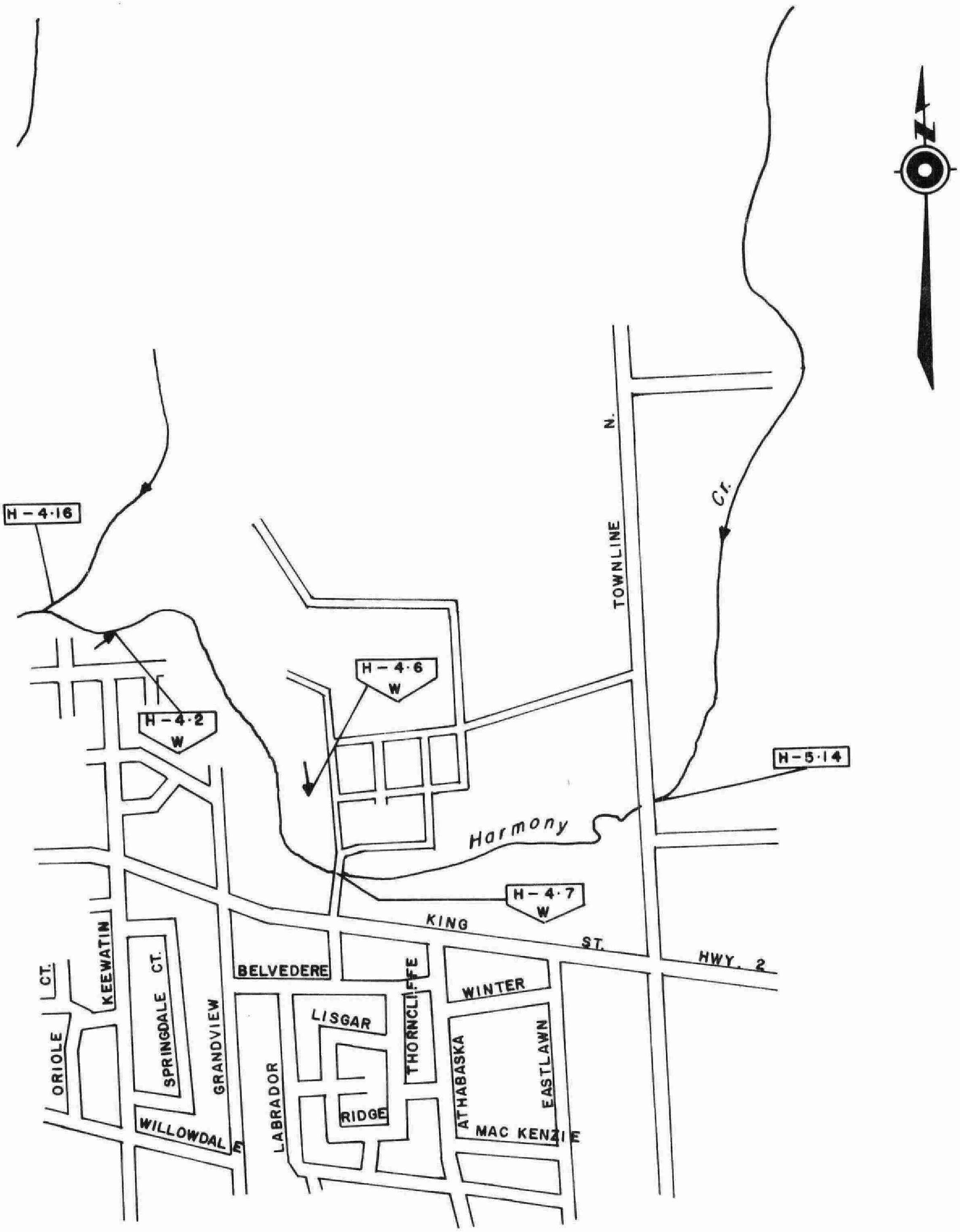
D — DRAINAGE DITCH

W — STORM SEWER

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
HARMONY CREEK
(MAIN BRANCH)
Nº : 3

| | |
|---|---|
| SCALE : 1050 0 1050 FT. | |
| DRAWN BY : L. L. BROOME | DATE : SEPTEMBER 1970 |
| CHECKED BY : J.C. | DRAWING Nº : 70-144-DE |




LEGEND

H-5·14 — STREAM SAMPLING POINT SHOWING MILEAGE

H-4·7 W — OUTFALL SHOWING STREAM AND MILEAGE — TYPE OF OUTFALL

W — STORM SEWER

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
HARMONY CREEK
(MAIN BRANCH)
Nº: 4

| | |
|---|---|
| SCALE: 1050 0 1050 FT. | |
| DRAWN BY: L. L. BROOME | DATE: SEPT, 1970 |
| CHECKED BY: J. C. | DRAWING Nº: 70-143-DE |


## LEGEND

HW-3·30 — STREAM SAMPLING POINT SHOWING MILEAGE

HWO-4·52 D — OUTFALL SHOWING STREAM AND MILEAGE
— TYPE OF OUTFALL

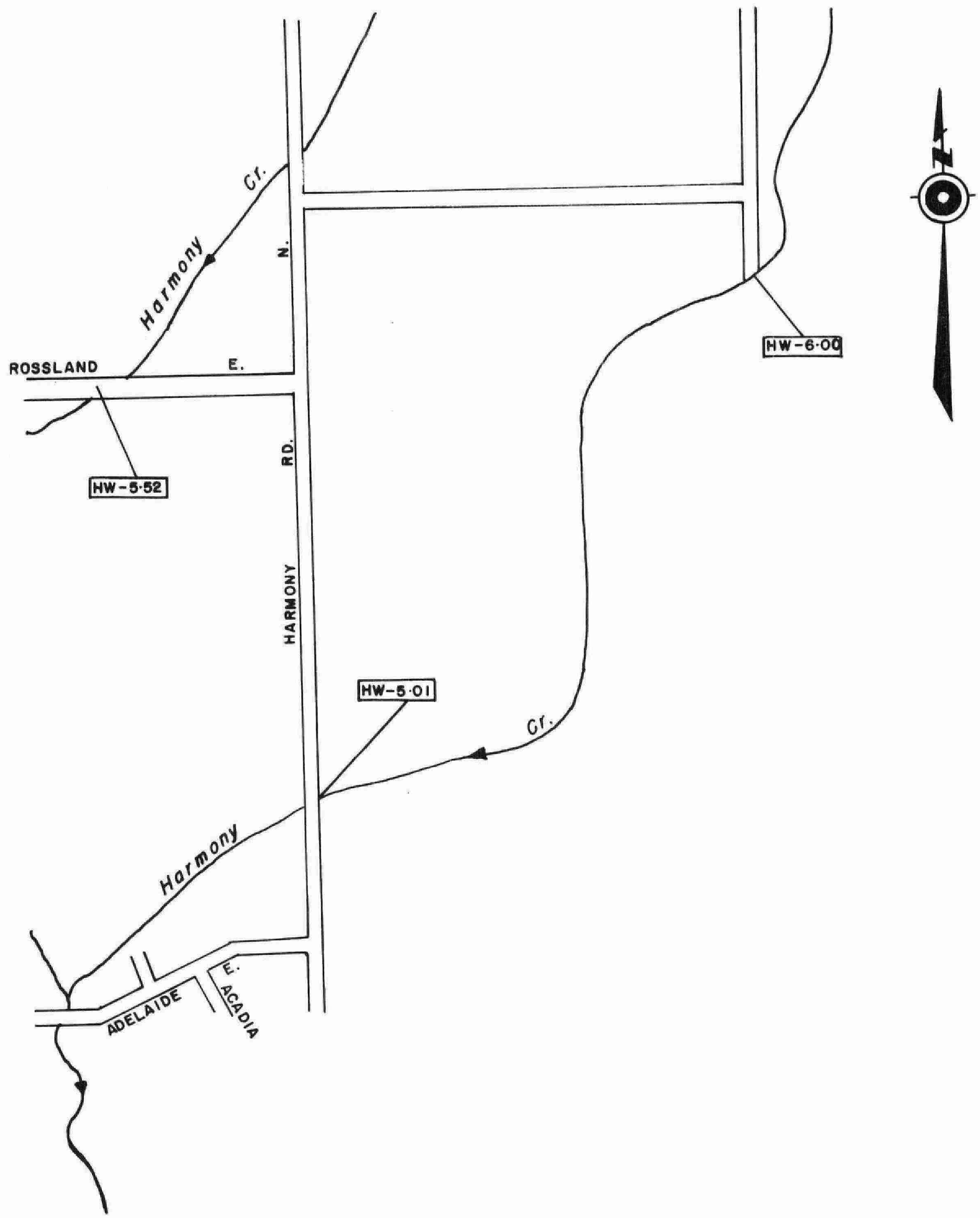
D — DRAINAGE DITCH

W — STORM SEWER

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
HARMONY CREEK
(WEST AND NORTHWEST BRANCHES)
Nº : 5

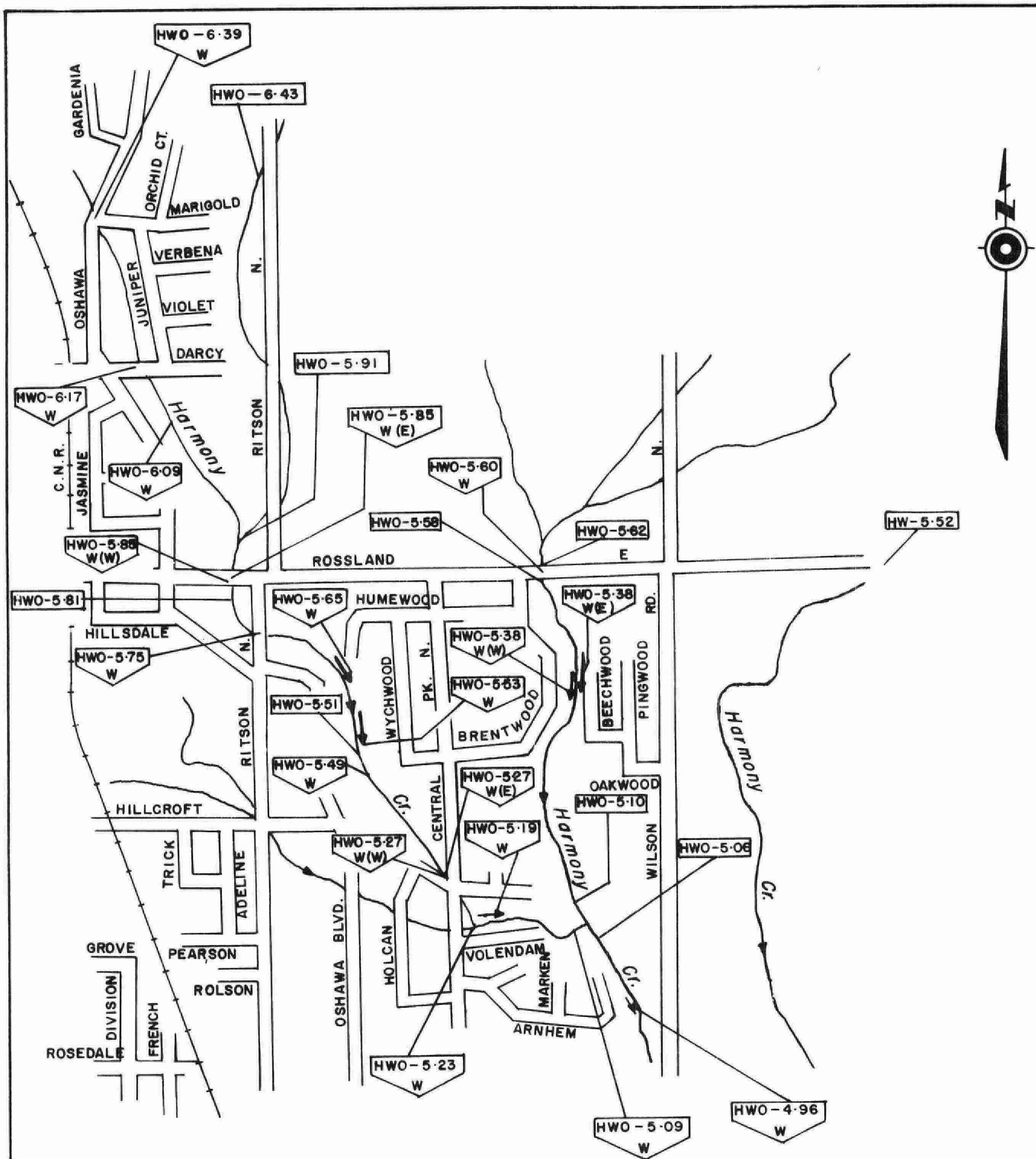
| | |
|---|---|
| SCALE : 1050 0 1050 FT. | |
| DRAWN BY : L. L. BROOME | DATE : SEPTEMBER 1970 |
| CHECKED BY : J.C. | DRAWING Nº : 70-150-DE |




LEGEND

HW-5·01 – STREAM SAMPLING POINT SHOWING MILEAGE

| | |
|---|---|
| ONTARIO WATER RESOURCES COMMISSION | |
| CITY OF OSHAWA<br>HARMONY CREEK<br>(WEST BRANCH)<br>Nº : 6 | |
| SCALE : 1050 0 1050 FT. | |
| DRAWN BY : L. L. BROOME | DATE : SEPT., 1970 |
| CHECKED BY : J. C. | DRAWING Nº : 70-142-DE |




## LEGEND

HWO-5·62 — STREAM SAMPLING POINT SHOWING MILEAGE

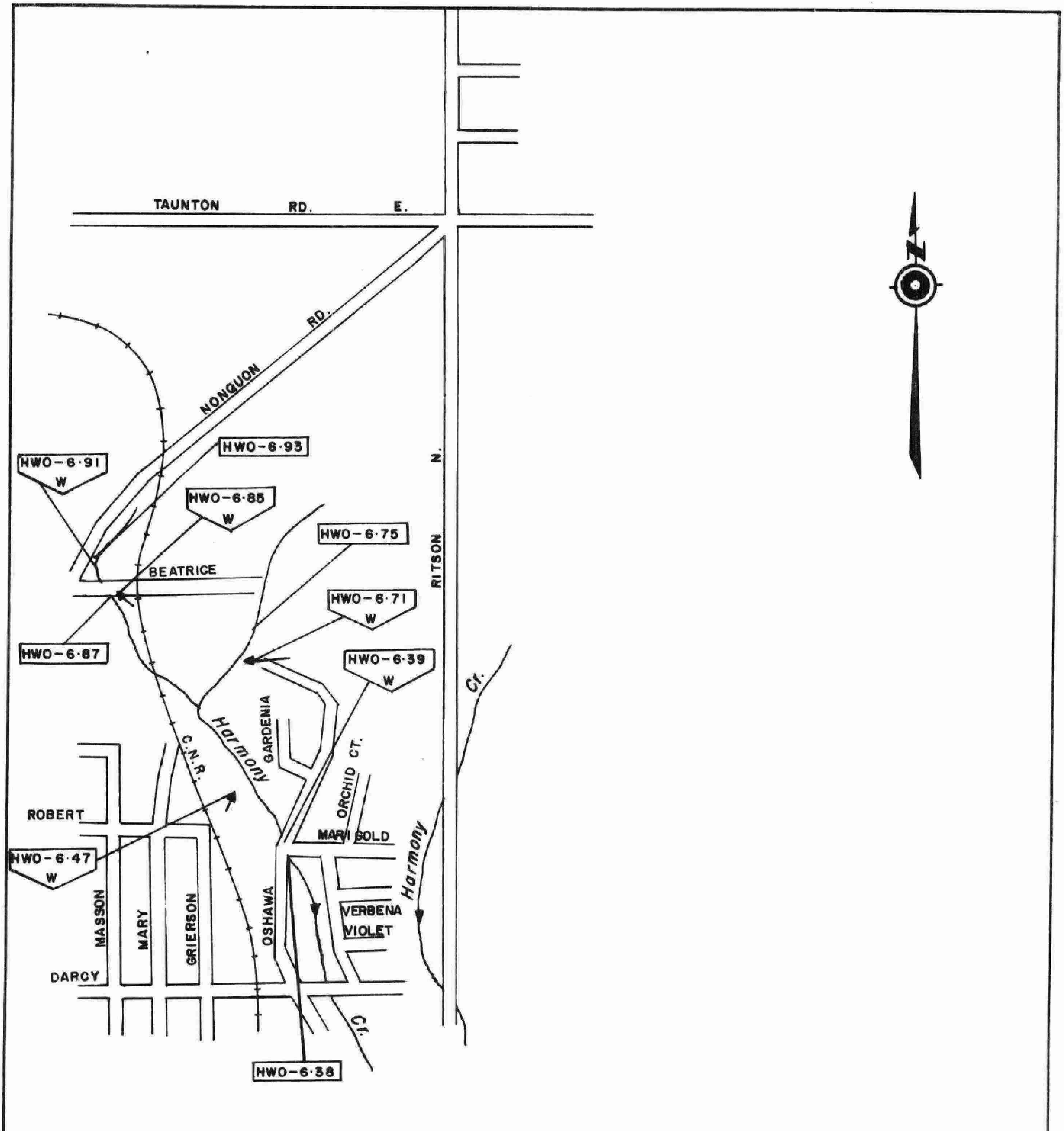
HWO-5·23 W — OUTFALL SHOWING STREAM AND MILEAGE — TYPE OF OUTFALL

W — STORM SEWER

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
HARMONY CREEK
(NORTHWEST BRANCH)
Nº : 7

| | |
|---|---|
| SCALE : 1050 0 1050 FT. | |
| DRAWN BY: L.L. BROOME | DATE : OCTOBER 1970 |
| CHECKED BY: J.C. | DRAWING Nº: 70-166-DE |




## LEGEND

HWO-6·38 — STREAM SAMPLING POINT SHOWING MILEAGE

HWO-6·47 W — OUTFALL SHOWING STREAM AND MILEAGE — TYPE OF OUTFALL

W — STORM SEWER

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
HARMONY CREEK
(NORTHWEST BRANCH)
Nº : 8

SCALE : 1050 0 1050 FT.

DRAWN BY : L. BROOME | DATE : OCTOBER, 1970

CHECKED BY : J.C. | DRAWING Nº : 70-165-DF

APPENDIX VIII

City of Oshawa

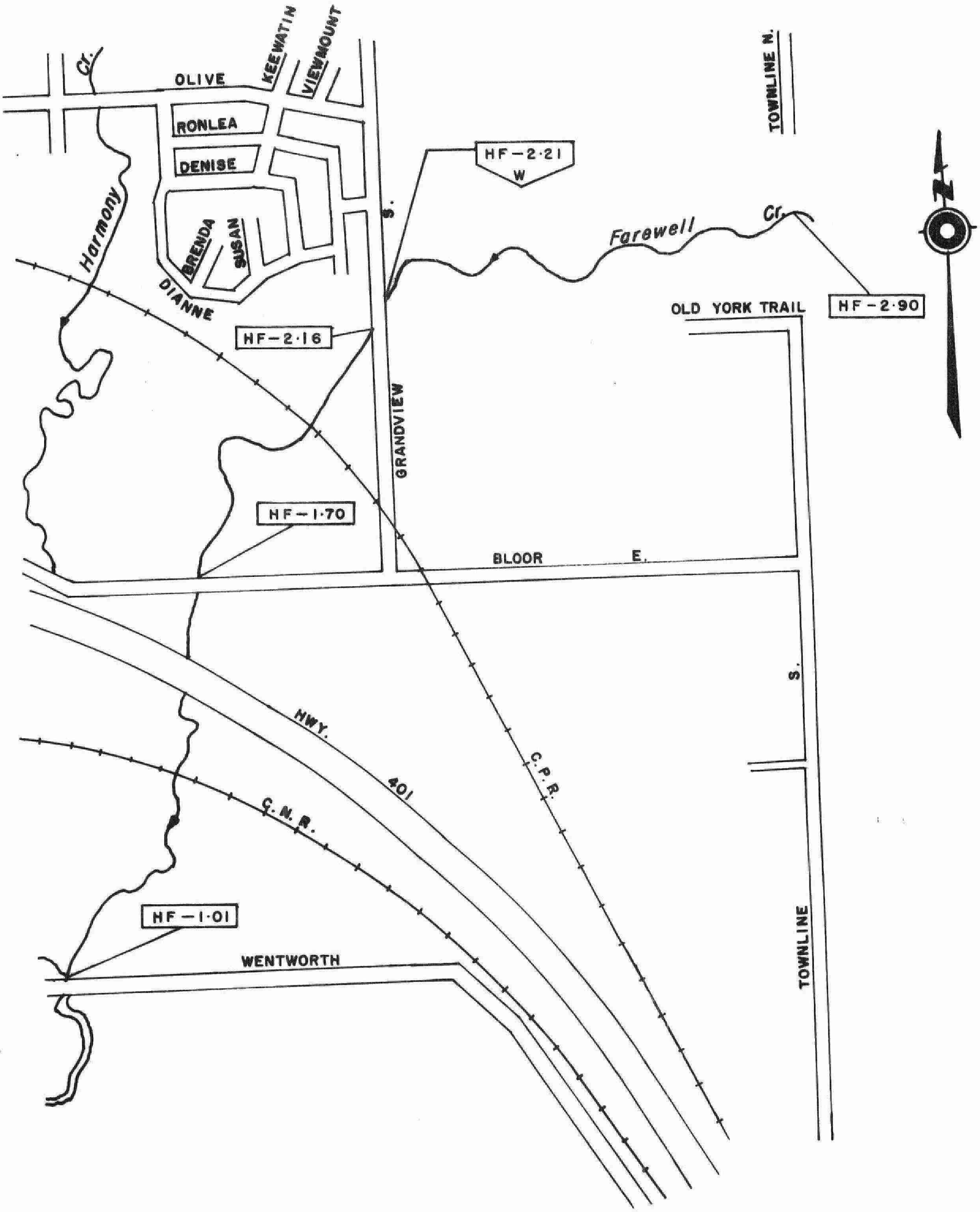
Water Pollution Survey

1970

Map

of

Farewell Creek




## LEGEND

HF-1·01 – STREAM SAMPLING POINT SHOWING MILEAGE

HF-2·21 W – OUTFALL SHOWING STREAM AND MILEAGE
– TYPE OF OUTFALL

W – STORM SEWER

ONTARIO WATER RESOURCES COMMISSION

CITY OF OSHAWA
FAREWELL CREEK

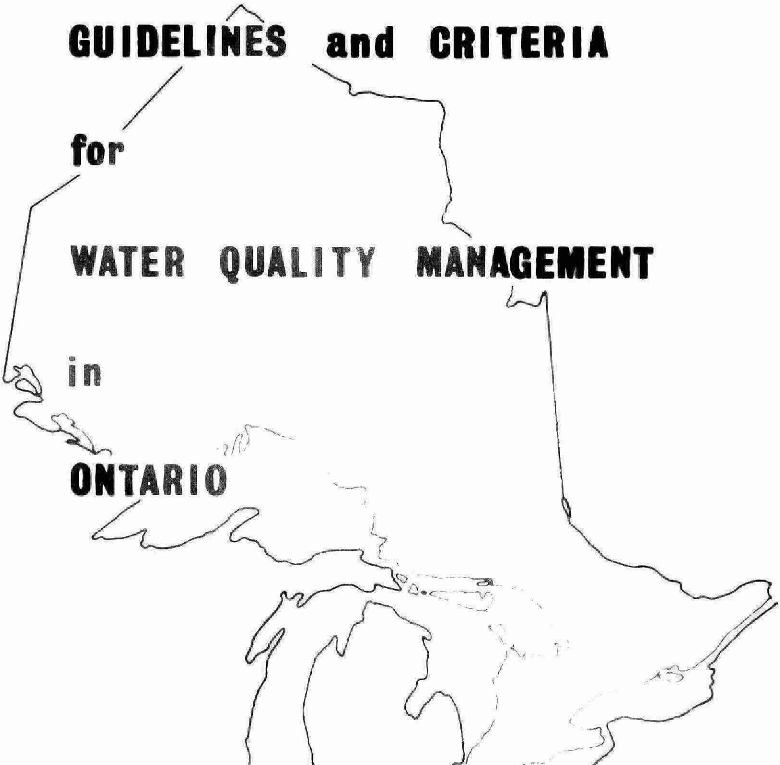
SCALE : 1050 0 1050 FT.

| | |
|---|---|
| DRAWN BY: L.L.BROOME | DATE: SEPTEMBER 1970 |
| CHECKED BY: J.C. | DRAWING Nº: 70-145-DE |

Ontario
Water Resources Commission

June 1970

# GUIDELINES and CRITERIA for WATER QUALITY MANAGEMENT in ONTARIO



# GUIDELINES AND CRITERIA

FOR

# WATER QUALITY MANAGEMENT IN ONTARIO

BY THE

ONTARIO WATER RESOURCES COMMISSION

HON. G. A. KERR, Q.C.
Minister

J. H. H. ROOT, M.P.P.
Vice-Chairman

D. J. COLLINS,
Chairman

135 St. Clair Avenue W., Toronto 7, Ontario
June, 1970

## TABLE OF CONTENTS

## LIST OF TABLES

# INTRODUCTION

In 1967, the Ontario Water Resources Commission announced its Policy Guidelines for Water Quality Control in the Province of Ontario. This publication contains a re-statement of the guidelines and introduces water quality criteria for various uses including public, agricultural and industrial water supply, recreation, aesthetic enjoyment and the propagation of fish and wildlife. The use of water for assimilation and dilution of treated wastes must take into consideration these many desirable uses. Application of the criteria to water uses within the drainage basins of the province, or parts thereof, will lead to the development of water quality standards for the control of water pollution.

# GUIDELINES FOR THE CONTROL OF WATER QUALITY

1 The water resources of Ontario must meet many needs, some of which are in conflict. The standards established, therefore, must be based on the best interests of the people of Ontario. These interests require the preservation, and restoration where necessary, of the quality of our water for the greatest number of uses. The use of water for the assimilation and dilution of treated waste effluents must take into consideration the variety of uses, including public, agricultural and industrial supply, recreation, aesthetic enjoyment and the propagation of fish and wildlife.

2 For each use of water there are certain water quality characteristics, identified as criteria, which should be met to ensure that the water is suitable for that use.

3 Water quality standards will be established by the Ontario Water Resources Commission for waters of drainage basins or parts thereof with important water uses, following consultation with agencies or persons having an interest or responsibility in the present or future use of the water in the basin for which the standards are to be established.

4 Water of a higher quality than that required by the standards will be maintained at that higher quality unless in the public interest an alteration of the quality is consistent with the protection of all uses which are in accordance with the water quality standards established.

There should be a constant effort to improve the quality of water, for it is recognized that the improvement of the quality of water makes it available for more uses.

5 Requirements for effluents and land drainage based on the applicable water quality standards, or criteria where such standards do not exist, will be established by the Commission in order to maintain acceptable water quality. More stringent methods of control and/or treatment of waste inputs and land drainage may become necessary as the use of water changes or increases, or as standards are re-defined.

6 In establishing effluent requirements from water quality standards a reserve capacity of the receiving water should be set aside to provide an adequate margin of protection in recognition of the limitations of water management theory and practice.

7 All wastes prior to discharge to any receiving watercourse must receive the best practicable treatment or control. Such treatment must be adequate to protect and wherever possible upgrade water quality in the face of population and industrial growth, urbanization and technological change.

8 Criteria and standards of water quality and effluent requirements will be defined quantitatively only where sound numerical information is available; otherwise, they will be described in appropriate detail. They will be re-defined from time to time in the light of new evidence.

# WATER QUALITY CRITERIA

The following criteria for water quality are a set of numerical and descriptive characteristics, carefully defined, and applicable to each major water use category such as agriculture; fish, other aquatic life and wildlife; industrial water supply; public water supply; recreation and aesthetics. The criteria are described for use in establishing Water Quality Standards for drainage basins which in turn will be used to determine Effluent Requirements for discharges of wastes and land drainage.

The responsibility for demonstrating that a waste effluent is harmless to water uses in the concentrations to be found in the receiving waters, rests with those producing the discharge. Zones of passage and/or mixing adjacent to outfalls at the limit of which water quality may be critical, will be prescribed by the Commission.

Reference is frequently made in the Criteria to the Report of the Committee on Water Quality, Federal Water Pollution Control Administration, U.S. Department of the Interior (1968). Acknowledgement of the report is gratefully given in recognition of its basic reference value.

## ZONES OF PASSAGE AND MIXING

Mixing zones in the vicinity of outfalls should be restricted as much as possible in extent and should provide for the safe passage of both fish and free-floating and drift organisms. Every precaution should be taken to ensure that at least two-thirds of the total cross-sectional area of a river or stream is characterized by a quality which is entirely favourable to the aquatic community at all times. In most cases this would preclude the use of a diffuser outfall which would distribute effluent uniformly across the river or stream. The water quality standard which defines the acceptable concentration of a substance contained in a waste discharge will apply at the periphery of the mixing zone or other specified sampling location.

Within mixing zones, it should be recognized that toxic wastes which will not evoke an avoidance response on the part of fish or other organisms should not be permitted. Where toxic materials are being discharged it should be assumed that the various components in the waste, regardless of the form in which they are present, may eventually be altered to the most toxic form in the aquatic environment. Adequate treatment of all wastes should be provided and mixing zones should not be considered as a substitute for proper treatment.

## STATISTICAL PROBLEMS IN SETTING LIMITS

The systematic surveillance of water and waste sources requires the collection of data to clearly represent the problems being studied. The problems are many and varied. In one case the average condition over a period of time may be required and the question arises over what period shall the average or median be taken; in another, the limit may be a figure that should not be exceeded at any time. If a standard for a certain constituent is "none", the question arises "how small an amount does this mean?" The answers vary with the type of standard and the circumstances governing the fluctuation of the indicator. In ground water problems, only the average over a considerable period of time is significant. Where required in the setting of standards and effluent requirements, definitions of limits will include the applicable sampling conditions, quantitative values and rates of discharge.

## 1 WATER QUALITY CRITERIA FOR AGRICULTURAL USES (AGR)

Agricultural production requires water of suitable quality for a variety of uses. Criteria for the major uses are given under three headings: Dairy Sanitation, Livestock Watering, and Irrigation.

Requirements for domestic and other farmstead uses and the common requirements for dairy sanitation are given elsewhere in the criteria for Private Water Supplies and Public Water Supplies.

### AGR-1 Dairy Sanitation

Modern methods for bulk handling of milk on farms require large volumes of good quality water to ensure a premium product. The quality of water needed for good dairy sanitation requires criteria for certain parameters that are additional to, or more stringent than, those required for private water supplies. These are summarized under the headings "Permissible Criteria" and "Desirable Criteria". They should be used in conjunction with the criteria for public and private water supplies.

Treatment may prove satisfactory in meeting the criteria for certain of the inorganic chemicals such as iron and total hardness.

Waters that meet the desirable microbiological criteria can be used without disinfection; those meeting the permissible criteria require disinfection (chlorination), or chlorination and filtration, before use to reduce bacteria to levels where they will not cause deterioration of the quality of milk. Waters used for dairy sanitation should be sampled and tested at least monthly, in some cases daily, to ensure that they meet the microbiological criteria.

**TABLE AGR-1**

**Water Quality Criteria for Agricultural Uses**
**Dairy Sanitation**

| Constituent or Characteristic | Permissible Criteria | Desirable Criteria |
|---|---|---|
| Inorganic Chemicals: | | |
| Copper | 0.1 mg/l | |
| Iron | 0.1 mg/l | |
| pH (range) | 6.8 to 8.5 | |
| Potassium | 20 mg/l | |
| Total hardness as $CaCO_3$ | 150 mg/l | 100 mg/l |
| Microbiological: | | |
| Proteolytic and/or Lipolytic bacteria (20°C) (individual results) | 500/100 ml | 0/100 ml |
| Yeast | | Absent |
| Mould | | Absent |
| Physical: | | Clear |
| | | Colourless |
| | | Good taste |

**AGR-2 Livestock Watering**

The health and productivity of livestock are affected by the quantities of various substances ingested as feed and as water. Accordingly, the amounts of certain substances that can be present without harm in water consumed by livestock will depend in part on the amounts of the same substances that are present in the feed in addition to a number of other factors which include: the daily water requirements and the species, age, and physiological condition of the animals, and the nature and quantities of other constituents of the feed and water.

Animals may be able to tolerate a fairly high level of total dissolved solids or bacteria if they are accustomed to such levels, but may be unable to tolerate a sudden change from waters with low dissolved solids or bacteria to waters with high dissolved solids or bacteria.

In addition to direct effects on the animals, certain substances may contaminate animal products to the point where they will not be acceptable for human consumption.

The variability of the factors that influence the acceptability of water for livestock-watering purposes must be considered when using the water quality criteria. Although the criteria provide a general guide to the quality of water that will be acceptable for most livestock, there may be cases where water of different quality than that indicated by the criteria will be required or acceptable because of the nature, age, or condition of species being raised or because of special rearing conditions or feed components. In such cases, or where the quality of an individual supply is in doubt, the quality should be assessed in relation to the specific use.

Water meeting the permissible criteria will be satisfactory for most livestock under normal rearing conditions. Water meeting the desirable criteria should provide a palatable and safe source for all normal livestock-watering purposes.

**TABLE AGR-2**
**Water Quality Criteria for Agricultural Uses**
**Livestock**

| Constituent or Characteristic | Permissible Criteria | Desirable Criteria |
|---|---|---|
| General Quality | | ideally should meet the desirable criteria for private water supplies. |
| Inorganic Chemicals: | | |
| Total Dissolved Solids | 2500 mg/l | < 500 mg/l |
| Arsenic | 0.05 mg/l | Absent |
| Cadmium | 0.01 mg/l | Absent |
| Chromium (hexavalent) | 0.05 mg/l | Absent |
| Fluoride | 2.4 mg/l | 1.2 mg/l |
| Lead | 0.05 mg/l | Absent |
| Nitrate plus Nitrite (as N) | 20 mg/l | < 10 mg/l |
| Selenium | 0.01 mg/l | Absent |
| Sulphate | 1000 mg/l | < 250 mg/l |
| Radioactivity: | | |
| Radium-226 | 3 pc/l | < 1 pc/l |
| Strontium-90 | 10 pc/l | < 2 pc/l |
| Gross beta activity in the known absence of strontium-90 and alpha-emitting radionuclides. | 1000 pc/l | < 100 pc/l |
| Microbiological: (1) | | |
| Enterococci (35°C) | < 40/100 ml | 0/100 ml |
| Algae | No heavy growth of blue-green algae | |

(1) The supply should be free of barnyard runoff and of effluent contamination from either man or animals. The geometric mean of sample results should not exceed the values given.

**AGR-3 Irrigation**

The suitability of water for irrigation cannot be defined precisely because the effects of the water on the crop being irrigated depend on many factors. These include: soil types, climatic conditions, irrigation practices, variations in the relation between the concentration and composition of the irrigation water and the soil solution, variations in the tolerance of different plants to the combined or individual constituents in the irrigation water or the soil solution, and the modifying effects of interrelations between and among the constituents. In general, for satisfactory irrigation, soils with poor drainage characteristics require water of higher quality than better drained soils.

In humid areas, excessive concentrations of salts or individual elements will normally be leached from the soil during periods of heavy rainfall or snowmelt before or after the growing season. This leaching action is another factor affecting the quality of water that can be used for irrigation. It may allow the use of water of poorer quality than that listed in these criteria for some crops and conditions without serious detrimental effects. Also through proper timing and adjustment of frequency and volumes of water applied, detrimental effects of poorer quality water may often be mitigated. Good drainage of soil may be a factor of similar importance as the quality of the water used.

The presence of sediment, pesticides, or pathogenic organisms in irrigation water, which may not specifically affect plant growth, may affect the acceptability of the product. Larger sediment particles could lead to plugging of sprinkler nozzles.

Although there are many variations in the quality of water that is suitable for specific irrigation uses, water quality criteria have been assembled as a guide to the quality of water that will meet many irrigation needs. The criteria are listed as permissible and desirable. Water meeting the desirable criteria should be satisfactory for irrigation of most crops in most soil types for long periods of time. Water meeting the permissible criteria, while suitable for many crops, soil and climatic conditions, could result in decreased yields for some crops if it is used repeatedly, unless there is dilution or leaching by precipitation or the application of excess irrigation water under favourable drainage conditions. Special crops or conditions, such as the growing of plants in greenhouses, may require irrigation with water of higher quality than that indicated by the desirable criteria.

The suitability of a given source of water for specific crops, soil types, and climatic conditions should be judged on an individual basis if its suitability has not been demonstrated by practice.

## TABLE AGR-3

### Water Quality Criteria for Agricultural Uses
### Irrigation

| Constituent or Characteristic | Permissible Criteria | Desirable Criteria |
|---|---|---|
| Physical: | | |
| Temperature | | 55°F to 85°F |
| Microbiological: (1) | | |
| Fecal Coliforms (44.5°C) | 100/100 ml | 0/100 ml |
| Enterococci (35°C) | 20/100 ml | 0/100 ml |
| Total bacteria (20°C) | 100,000/100 ml | < 10,000/100 ml |
| Inorganic Chemicals: | | |
| Aluminum | 20.0 mg/l | < 1.0 mg/l |
| Arsenic | 10.0 mg/l | < 1.0 mg/l |
| Beryllium | 1.0 mg/l | < 0.5 mg/l |
| Boron | 0.5 mg/l | 0.3 mg/l |
| Cadmium | 0.05 mg/l | < 0.005 mg/l |
| Chloride | 150 mg/l | < 70 mg/l |
| Chloride—special requirement for tobacco | 70 mg/l | < 20 mg/l |
| Chromium | 20.0 mg/l | < 5.0 mg/l |
| Cobalt | 10.0 mg/l | < 0.2 mg/l |
| Copper | 5.0 mg/l | < 0.2 mg/l |
| Lead | 20.0 mg/l | < 5.0 mg/l |
| Lithium | 5.0 mg/l | < 5.0 mg/l |
| Manganese | 20.0 mg/l | < 2.0 mg/l |
| Molybdenum | 0.05 mg/l | < 0.005 mg/l |
| Nickel | 2.0 mg/l | < 0.5 mg/l |
| pH (range) | 4.8 to 9.0 | |
| Residual Sodium Carbonate $=(CO_3^{--} + HCO_3^{-}) - (Ca^{++} + Mg^{++})$ expressed as mg eq/l | 1.25 mg eq/l | < 1.25 mg eq/l |
| Selenium | 0.05 mg/l | < 0.05 mg/l |
| Sodium Adsorption Ratio $= \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$ expressed as mg eq/l | 6 | < 4 |
| Total dissolved solids | 500 mg/l | < 200 mg/l |
| Vanadium | 10.0 mg/l | < 10.0 mg/l |
| Zinc | 5.0 mg/l | < 5.0 mg/l |
| Organic Chemicals: | | |
| Pesticides | Insecticides, herbicides, fungicides, and rodenticides must not be present in waters used for irrigation in concentrations that are detrimental to crops, livestock, wildlife or man. | Absent |

(1) The geometric mean of sample results should not exceed the values given.

## 2 WATER QUALITY CRITERIA FOR THE PROTECTION OF FISH, OTHER AQUATIC LIFE AND WILDLIFE (F & W)

The following criteria are considered to be satisfactory for fish, other aquatic life and wildlife. Reference is made to aspects of water quality considered to be most important in the light of current knowledge. Narrative guidelines are offered where quantification is not yet possible.

### Dissolved Materials

Dissolved materials should not be added to increase the concentration of dissolved solids by more than one-third of the natural condition of the receiving water, owing to potentially harmful osmotic effects of high concentrations. Dissolved materials that are harmful in relatively low concentrations are discussed in the section "Toxic Substances".

### pH, Alkalinity, Acidity

(1) pH should be maintained within a range of 6.5 to 8.5.

(2) To protect the carbonate system, and thus the productivity of the water, acid should not be added in sufficient quantity to lower the total alkalinity to less than 20 mg/l.

### Temperature

(1) **General**

Unless a special study shows that discharge of a heated effluent into the hypolimnion of a lake will be desirable, such practice is not recommended and water for cooling should not be pumped from the hypolimnion to be discharged to the same body of water.

The normal daily and seasonal temperature variations that were present before the addition of heat due to other than natural causes should be maintained.

Wherever possible, heated discharges should be located where elevated temperature will enhance public utilization of the water by supporting a wider variety of water uses.

(2) **Great Lakes and Connecting Waters**

(a) Heated discharges are not permitted that may stimulate production of nuisance organisms or vegetation or that are or may become injurious to wildlife, waterfowl, fish or other aquatic life or the growth and reproduction thereof. For each discharge of a heated effluent, acceptable mixing zones will be established on the basis of features and facts pertinent to that specific situation.

(b) Heat may not be discharged in the vicinity of spawning areas or where increased water temperature might interfere with recognized movements of spawning or migrating fish populations.

(3) **Inland Waters**

(a) Heated discharges to inland waters will not be permitted unless it is clearly demonstrated that heated effluents will enhance the usefulness of the water resource without endangering the production and optimum maintenance of wildlife, fish and other aquatic species. It shall be the responsibility of the user to provide evidence to support the acceptability of the discharge under these terms.

(b) Inland trout streams, salmon streams, trout and salmon lakes and the hypolimnion of lakes and reservoirs containing salmonids and other cold water forms should not be warmed.

(c) Heat may not be discharged in the vicinity of spawning areas or where increased temperature might interfere with recognized movements of spawning or migrating fish populations.

### Dissolved Oxygen

(1) **Warm-water Biota**

The dissolved oxygen (DO) concentration should be above 5 mg/l at all times, except that in certain situations concentrations may range between 5 and 4 mg/l for short intervals within any 24-hour period provided that water quality is favourable in all other respects.

(2) **Cold-water Biota**

In spawning areas, DO levels must not be below 7 mg/l at any time. Elsewhere, DO concentrations should not be below 6 mg/l. In certain situations, they may range between 6 and 5 mg/l for short intervals within any 24-hour period, provided the water quality is favourable in all other respects.

### Carbon Dioxide

The 'free' carbon dioxide concentration should not exceed 25 mg/l.

### Oil

Oil, petrochemicals or other immiscible substances that will cause visible films or toxic, noxious or nuisance conditions should not be added to water.

### Turbidity

(1) Turbidity associated with waste inputs should not exceed 50 Jackson units in warm-water streams or 10 Jackson units in cold-water streams.

(2) There should be no discharge which would cause turbidities exceeding 25 Jackson units in warm-water lakes or 10 Jackson units in cold-water or oligotrophic lakes.

**Settleable Materials**

Substances should not be added that will adversely affect the aquatic biota or will create objectionable deposits on the bottom or shore of any body of water.

**Colour and Transparency**

For effective photosynthetic production of oxygen, it is required that 10 per cent of the incident light reach the bottom of any desired photosynthetic zone in which adequate dissolved oxygen concentrations are to be maintained.

**Floating Materials**

All floating materials, other than those of natural origin, should be excluded from streams and lakes.

**Tainting substances**

All materials that will impart odour or taste to fish or edible invertebrates should be excluded from receiving waters at levels that produce tainting.

**Radionuclides**

Radioactive materials should not be present in natural waters as a consequence of failure to exercise necessary controls of radioactivity releases to keep exposure to a minimum.

Experience has shown that standards established for drinking water assure that people will receive no more than currently acceptable amounts of radioactive materials from aquatic sources and that fish and other aquatic life will not receive an injurious dose of radiation.

Thus, present standards accepted for the protection of fish and other aquatic life are as follows:

| | pc/l |
|---|---|
| Gross beta emitters | 1000 |
| Radium-226 | 3 |
| Strontium-90 | 10 |

Where other radioisotopes occur, the significance of the exposure of aquatic species to these forms of radiation should be assessed for each situation, both with respect to potential damage to the organisms themselves and to humans where fish or other edible forms are utilized.

**Plant Nutrients and Nuisance Growths**

(1) Nutrients from unnatural sources that will stimulate production of algae, nuisance vegetation or offensive slime growths should not be added to water. The addition of sulphates or manganese oxide to a lake should be limited if iron is present in the hypolimnion as these substances may increase the quantity of available phosphorus.

(2) Organic or other materials that will promote an increased zone of anaerobic decomposition within a lake, reservoir or other body of water should not be allowed to enter the water.

(3) The naturally-occurring ratios of nitrogen (particularly $NO_3$ and $NH_4$) to total phosphorus, and their amounts, should not be radically changed by the addition of materials from waste sources and land drainage.

**Toxic Substances**

Toxic substances must not be added to water in concentrations or combinations that are toxic or harmful to human, animal, plant or aquatic life, except where the application of approved substances for the control of nuisance organisms has been authorized by the Commission (Section 28b, OWRC Act).

The evaluation of toxicity for aquatic organisms is based on use of the TLm or median tolerance limit. This represents the concentration at which half the test organisms will succumb over a given period of exposure such as 24, 48 or 96 hours. It does not, therefore, represent the safe concentration and an application factor is applied to ensure a safe condition, including allowance for sub-lethal effects.

(1) **Substances of Unknown Toxicity**

All effluents containing foreign materials should be considered harmful and not permissible until bioassay tests have shown otherwise. The onus for demonstrating that an effluent is harmless in the concentrations to be found in the receiving waters rests with those responsible for the discharge. Information concerning acceptable bioassay procedures is available from the Commission.

(2) **Application Factors**

Concentration of materials that are non-persistent (that is, have a half-life of less than 96 hours), or have non-cumulative effects after mixing with the receiving waters, should not exceed 1/10 of the applicable 96-hour TLm value at any time or place based on species representative of local conditions. The 24-hour average of the concentration of these materials should not exceed 1/20 of the TLm value after mixing. For other toxicants, the concentrations should not exceed 1/20 and 1/100 of the TLm value under the aforementioned conditions.

(3) **Additive Effects**

When two or more toxic materials that have additive effects are present at the same time in the receiving water, some reduction is necessary in the permissible concentrations as derived from bioassays on individual substances or wastes. The amount of reduction required is a function of both the number of toxic materials present and their concentrations in respect to the derived permissible concentration. An appropriate means of assuring that the combined

amounts of the several substances do not exceed a permissible concentration for the mixture is through the use of the following relationship:

$$\left(\frac{C_a}{L_a} + \frac{C_b}{L_b} \ldots + \frac{C_n}{L_n} \leq 1\right)$$

where $C_a$, $C_b$,.......$C_n$ are the measured concentrations of the several toxic materials in the water and $L_a$, $L_b$, .......... $L_n$ are the respective permissible concentration limits derived for the materials on an individual basis. Should the sum of the several fractions exceed one, then a local restriction on the concentration of one or more of the substances is necessary.

(4) **Pesticides**

(a) Chlorinated Hydrocarbons:

Any addition of chlorinated hydrocarbon insecticides is likely to cause damage to some desired organisms and their use should be avoided.

(b) Other Chemical Pesticides:

Other pesticides and herbicides gaining access to water can cause damage to desirable organisms and should be used with utmost discretion and caution. Tables F & W-1 and F & W-2 list the 48-hour TLm values of a number of pesticides for various types of fresh water organisms. To provide reasonably safe concentrations of these materials in receiving waters, application factors ranging from 1/10 to 1/100 should be used, with these values depending on the characteristic of the pesticide in question and used as specified in (2) above. Concentrations thus derived may be considered tentatively safe under the conditions specified. TLm values and related application factors are subject to revision as additional bioassay information is obtained for species which may be more representative of local conditions.

(5) **Other Toxic Substances**

(a) ABS: The concentration of ABS should not exceed 1/7 of the 48-hour TLm at any time or place.

(b) LAS: The concentration of LAS should not exceed 1/7 of the 48-hour TLm at any time or place.

(c) ARSENIC: An application factor of 1/100 should be applied to the 96-hour TLm value as a tentative safe concentration for continuous exposure. An environmental level of .01 mg/l should not be exceeded under any circumstances.

(d) AMMONIA: Permissible concentrations of ammonia should be determined by the flow-through bioassay with the pH of the test solution maintained at 8.5, DO concentrations between 4 and 5 mg/l, and temperatures near the upper allowable levels.

(e) CADMIUM: The concentration of cadmium must not exceed 1/500 of the 96-hour TLm concentration at any time or place.

(f) CHROMIUM: The concentration of chromium should not exceed 1/100 of the 96-hour TLm at any time or place.

(g) COPPER: The maximum copper (expressed as Cu) concentration at any time or place shall not be greater than 1/12 of the 96-hour TLm value. The maximum permissible concentration for continuous exposure is between 3 per cent and 7 per cent of the 96-hour TLm.

(h) LEAD: The concentration of lead should not exceed 1/20 of the 96-hour TLm at any time or place and the 24-hour average should not exceed 1/100 of the 96-hour TLm concentration after mixing.

(i) MERCURY: Owing to demonstrated cumulative effects of mercury in fish, and the attendant hazard to other animals, discharges of mercury to water should be avoided.

(j) NICKEL: The concentration of nickel should not exceed 1/50 of the 96-hour TLm concentration at any time or place.

(k) ZINC: The concentration of zinc should not exceed 1/100 of the 96-hour TLm concentration at any time or place.

## TABLE F & W-1 INSECTICIDES*

(48-hour TLm values from static bioassay, in micrograms per litre. Exceptions are noted.)

| Pesticide | Stream Invertebrate[1] Species | Stream Invertebrate[1] TLm | Cladocerans[2] Species | Cladocerans[2] TLm | Fish[3] Species | Fish[3] TLm | Gammarus Lacustris,[4] TLm |
|---|---|---|---|---|---|---|---|
| Abate | Pteronarcys californica | 100 | | | Brook trout | 1,500 | 640 |
| Aldrin[5] | P. californica | 8 | Daphnia pulex. | 28 | Rainbow trout | 3 | 12,000 |
| Allethrin | P. californica | 28 | D. pulex | 21 | - do - | 19 | 20 |
| Azodrin | | | | | - do - | 7,000 | |
| Aramite | | | D. magna | 345 | Bluegill | 35 | 100 |
| Baygon[5] | P. californica | 110 | | | Fathead | 25 | 50 |
| Baytex[5] | P. californica | 130 | Simocephalus serrulatus | 3.1 | Brown t. | 80 | 70 |
| Benzene hexachloride (lindane) | P. californica | 8 | D. pulex | 460 | Rainbow t. | 18 | 88 |
| Bidrin | P. californica | 1900 | D. pulex | 600 | - do - | 8,000 | 790 |
| Carbaryl (sevin) | P. californica | 1.3 | D. pulex | 6.4 | Brown t. | 1,500 | 22 |
| Carbophenothion (trithion) | | | D. magna | 0.009 | Bluegill | 225 | 28 |
| Chlordane[5] | P. californica | 55 | S. serrulatus | 20 | Rainbow t. | 10 | 80 |
| Chlorobenzilate | | | S. serrulatus | 550 | - do - | 710 | |
| Chlorthion | | | D. magna | 4.5 | | | |
| Coumaphos | | | D. magna | 1 | | | 0.14 |
| Cryolite | | | D. pulex | 5,000 | Rainbow t. | 47,000 | |
| Cyclethrin | | | D. magna | 55 | | | |
| DDD (TDE)[5] | P. californica | 1100 | D. pulex | 3.2 | Rainbow t. | 9 | 1.8 |
| DDT[5] | P. californica | 19 | D. pulex | 0.36 | Bass | 2.1 | 2.1 |
| Delnav (dioxathion) | | | | | Bluegill | 14 | 690 |
| Delmeton (systex) | | | | 14 | - do - | 81 | |
| Diazinon[5] | P. californica | 60 | D. pulex | 0.9 | - do - | 30 | 500 |
| Dibrom (naled) | P. californica | 16 | D. pulex | 3.5 | Brook t. | 78 | 160 |
| Dieldrin[5] | P. californica | 1.3 | D. pulex | 240 | Bluegill | 3.4 | 1,000 |
| Dilan | | | D. magna | 21 | - do - | 16 | 600 |
| Dimethoate (cygon) | P. californica | 140 | D. magna | 2500 | - do - | 9600 | 400 |
| Dimethrin | | | | | Rainbow t. | 700 | |
| Dichlorvos[5] (DDVP) | P. californica | 10 | D. pulex | 0.07 | Bluegill | 700 | 1 |
| Disulfoten (di-syston) | P. californica | 18 | | | - do - | 40 | 70 |

* From Report of the Committee on Water Quality Criteria, Federal Water Pollution Control Administration, U.S. Department of the Interior (1968).

**TABLE F & W-1—continued**

| Pesticide | Stream Invertebrate[1] Species | TLm | Cladocerans[2] Species | TLm | Fish[3] Species | TLm | Gammarus Lacustris,[4] TLm |
|---|---|---|---|---|---|---|---|
| Dursban | Peteronareella badia | 1.8 | | | Rainbow t. | 20 | 0.4 |
| Endosulfan (thiodan) | P. californica | 5.6 | D. magna | 240 | - do - | 1.2 | 64 |
| Endrin[5] | P. californica | 0.8 | D. pulex | 20 | Bluegill | 0.2 | 4.7 |
| EPH | | | D. magna | 0.1 | - do - | 17 | 36 |
| Ethion | P. californica | 14 | D. magna | 0.01 | - do - | 230 | 3.2 |
| Ethyl guthion[5] | | | D. pulex | | Rainbow t. | | |
| Fenthion | P. californica | 39 | D. pulex | 4 | | | |
| Guthion[5] | P. californica | 8 | D. magna | 0.2 | Rainbow t. | 10 | 0.3 |
| Heptachlor[5] | P. badia | 4 | D. pulex | 42 | - do - | 9 | 100 |
| Kelthane (dicofel) | P. californica | 3000 | D. magna | 390 | - do - | 100 | |
| Kepone | | | | | - do - | 37.5 | |
| Malathion[5] | P. badia | 6 | D. pulex | 1.8 | Brook t. | 19.5 | 1.8 |
| Methoxychlor[5] | P. californica | 8 | D. pulex | 0.8 | Rainbow t. | 7.2 | 1.3 |
| Methyl parathion[5] | | | D. magna | 4.8 | Bluegill | 8000 | |
| Morestan | P. californica | 40 | | | - do - | 96 | |
| Ovex | P. californica | 1500 | | | - do - | 700 | |
| Paradichlorobenzene | | | | | Rainbow t. | 880 | |
| Parathion[5] | P. californica | 11 | D. pulex | 0.4 | Bluegill | 47 | 6 |
| Perthane | | | D. magna | 9.4 | Rainbow t. | 7 | |
| Phosdrin[5] | P. californica | 9 | D. pulex | 0.16 | - do - | 17 | 310 |
| Phosphamidon | P. californica | 460 | D. magna | 4 | - do - | 8000 | 3.8 |
| Pyrethrins | P. californica | 64 | D. pulex | 25 | - do - | 54 | 18 |
| Rotenone | P. californica | 900 | D. pulex | 10 | Bluegill | 22 | 350 |
| Strobane[5] | P. californica | 7 | | | Rainbow t. | 2.5 | |
| Tetradifon (tedion) | | | | | Bluegill | 1100 | 140 |
| TEPP[5] | | | | | Fathead | 390 | 52 |
| Thanite | | | D. magna | 450 | | | |
| Thimet | | | | | Bluegill | 5.5 | 70 |
| Toxaphene[5] | P. californica | 7 | D. pulex | 15 | Rainbow t. | 2.8 | 70 |
| Trichlorofon (dipterex)[5] | P. badia | 22 | D. magna | 8.1 | - do - | 160 | 60 |
| Zectran | P. californica | 16 | D. pulex | 10 | - do - | 8000 | 76 |

TABLE F & W-2

HERBICIDES, FUNGICIDES, DEFOLIANTS, ALGICIDES*

| Pesticide | Stream Invertebrate[1] Species | Stream Invertebrate[1] TLm | Cladocerans[2] Species | Cladocerans[2] TLm | Fish[3] Species | Fish[3] TLm | Gammarus Lacustris,[4] TLm |
|---|---|---|---|---|---|---|---|
| Ametryne | | | | | Rainbow t. | 3400 | |
| Aminotriazole | | | | | | | |
| Aquathol | | | | | Bluegill | 257 | |
| Atrazine | | | Daphnia magna | 3600 | Rainbow t. | 12,600 | |
| Azide, potassium | | | | | Bluegill | 1400 | 10,000 |
| Azide, sodium | | | | | - do - | 980 | 9000 |
| Copper chloride | | | | | - do - | 1100 | |
| Copper sulphate | | | | | - do - | 150 | |
| Dichlobenil | Pteronarcys californica | 44,000 | Daphnia pulex | 3700 | - do - | 20,000 | 1500 |
| 2,4-D PGBEE | | | D. pulex | 3200 | Rainbow t. | 960 | 1800 |
| 2,4-D BEE | P. californica | 1800 | | | Bluegill | 2100 | 760 |
| 2,4-D isopropyl | | | | | - do - | 800 | |
| 2,4-D butyl ester | | | | | - do - | 1300 | |
| 2,4-D butyl + isopropyl ester | | | | | - do - | 1500 | |
| 2,4,5-T isooctyl ester | | | | | - do - | 16,700 | |
| 2,4,5-T isopropyl ester | | | | | - do - | 1700 | |
| 2,4,5-T PGBE | | | | | - do - | 560 | |
| 2(2,4-DP) BEE | | | | | - do - | 1100 | |
| Dalapon | P. californica Very low toxicity | | D. magna | 6000 | Very Low Toxicity | | |
| Dead-X | P. californica | 5000 | D. pulex | 3700 | Rainbow t. | 9400 | 5600 |
| DEF | P. californica | 2300 | | | Bluegill | 36 | 230 |
| Dexon | P. californica | 42,000 | | | Bluegill | 23,000 | 6000 |
| Dicamba | | | | | non-toxic | | 5800 |
| Dichlone | | | D. magna | 26 | Rainbow t. | 48 | 11,500 |
| Difolitan | P. californica | 150 | | | Channel Cat | 31 | 6500 |
| Dinitrocresol | P. californica | 560 | | | Rainbow t. | 210 | |
| Diquat | | | | | Rainbow t. | 12,300 | |
| Diuron | P. californica | 2800 | D. pulex | 1400 | - do - | 4300 | 380 |
| Du-ter | | | | | Bluegill | 33 | |
| Dyrene | | | D. magna | 490 | | 15 | |
| Endothal, copper | | | | | Rainbow t. | 290 | |

* From Report of the Committee on Water Quality Criteria, Federal Water Pollution Control Administration, U.S. Department of the Interior (1968).

TABLE F & W-2—continued

| Pesticide | Stream Invertebrate[1] Species | TLm | Cladocerans[2] Species | TLm | Fish[3] Species | TLm | Gammarus Lacustris,[4] TLm |
|---|---|---|---|---|---|---|---|
| Endothal dimethylamine | | | | | Rainbow t. | 1150 | |
| Fenac, acid | P. californica | 70,000 | | | - do - | 16,500 | |
| Fenac, sodium | P. californica | 80,000 | D. pulex | 4500 | - do - | 7500 | 18,000 |
| Hydram (molinate) | P. californica | 3500 | | | - do - | 290 | |
| Hydrothol 191 | | | | | - do - | 690 | 1000 |
| Lanstan (Korax) | | | | | - do - | 100 | 5500 |
| LFN | | | | | - do - | 79 | |
| Paraquat | P. californica Very low toxicity | | D. pulex | 3700 | Very low toxicity | | 18,000 |
| Propazine | | | | | Rainbow t. | 7800 | |
| Silvex, PGBEE | | | D. pulex | 2000 | - do - | 650 | |
| Silvex, isoctyl | | | | | Bluegill | 1400 | |
| Silvex, BEE | | | | | - do - | 1200 | |
| Simazine | P. californica | 50,000 | | | Rainbow t. | 5000 | 21,000 |
| Sodium arsenite | P. californica Very low toxicity | | Simocephalus serrulatus | 1400 | - do - | 36,500 | |
| Tordon (picloram) | | | | | - do - | 2500 | 48,000 |
| Trifuralin | P. californica | 4200 | D. pulex | 240 | - do - | 11 | 5600 |
| Vernam[5] (vernolate) | | | | | - do - | 5900 | 25,000 |

1 Stonefly bioassay was done at Denver, Colo., and at Salt Lake City, Utah. Denver tests were in soft water (35 mg/l TDS), non-aerated, 60 F. Salt Lake City tests were in hard water (150 mg/l TDS), aerated, 48-50 F. Response was death.

2 Daphnia pulex and Simocephalus serrulatus bioassay was done at Denver, Colo., in soft water (35 mg/l TDS), non-aerated, 60 F. Daphnia magna bioassay was done at Pennsylvania State University in hard water (146 mg/l TDS), non-aerated, 68 F. Respone was immobilization.

3 Fish bioassay was done at Denver, Colo., and at Rome N.Y. Denver tests were with 2-inch fish in soft water (35 mg/l TDS), non-aerated, trout at 55 F.; other species at 65 F. Rome tests were with 2-2½ inch fish in soft water (6 mg/l TA: pH 5.85-6.4), 60 F. Response was death.

4 Gammarus bioassay was done at Denver, Colo., in soft water (35 mg/l TDS), non-aerated, 60 F. Response was death.

5 Becomes bound to soil when used according to directions, but highly toxic (reflected in numbers) when added directly to water.

## 3 WATER QUALITY CRITERIA FOR INDUSTRIAL WATER SUPPLIES (IWS)

Desired water quality criteria are tabled for the major industrial classifications as follows:

| | |
|---|---|
| Brewing and Soft Drinks | — IWS-1 |
| Chemical and Allied Products | — IWS-2 |
| Industrial Cooling | — IWS-3 |
| Food Processing | — IWS-4 |
| Electroplating and Metal Finishing | — IWS-5 |
| Iron and Steel | — IWS-6 |
| Petroleum | — IWS-7 |
| Pulp and Paper | — IWS-8 |
| Leather Tanning and Finishing | — IWS-9 |
| Textiles | — IWS-10 |

While the values listed should not normally be exceeded, these water quality criteria can vary considerably for the same industrial process depending on factors such as the technological age of plant design.

A raw surface water and/or ground water supply which is used by many different industries may not satisfy the widely varying criteria for each use. However, water treatment technology in its present state of development permits the utilization of surface water of literally any available quality to produce water of any desired quality at the point of use in industry.

Most industries located on municipal water supply systems find the quality of water provided to be satisfactory. If the water quality requirements of an industry are such that water of higher quality than that provided by the municipality is required for specific process use, the industry generally accepts the additional costs involved to produce the higher quality water.

### TABLE IWS-1

### WATER QUALITY CRITERIA FOR THE BREWING AND SOFT DRINK INDUSTRIES

(Unless otherwise indicated, units are mg/l)

| Characteristic | Concentration |
|---|---|
| Alkalinity ($CaCO_3$) | 85 |
| pH, units | (1) |
| Hardness ($CaCO_3$) | (1) |
| Chloride (Cl) | 250(2) |
| Sulphate ($SO_4$) | 250(2) |
| Iron (Fe) | 0.3(3) |
| Manganese (Mn) | 0.05 |
| Fluoride (F) | 1(3) |
| Dissolved solids | (1) |
| Organics: carbon chloroform extract (CCE) | 0.15(3) |
| Coliform bacteria, count/100 ml | (3) |
| Colour, units | 5(4) |
| Taste, threshold number | (4, 5) |
| Odour, threshold number | (4, 5) |

(1) Controlled by treatment for other constituents.
(2) For brewing, value should not exceed 100 mg/l.
(3) Not greater than OWRC Drinking Water Objectives.
(4) In general, public water supplies are given conventional treatment such as coagulation, filtration and chlorination. Any additional requirement for higher quality, for example, deionized water, is the responsibility of the industry. To ensure low organic content, activated carbon treatment is used by industry.
(5) Zero, not detectable by test.

### TABLE IWS-2

### WATER QUALITY CRITERIA FOR THE CHEMICAL AND ALLIED PRODUCTS INDUSTRIES*

(Unless otherwise indicated, units are mg/l)

| Characteristic | Concentration[1] |
|---|---|
| Alkalinity (as $CaCO_3$) | 150 |
| Iron (Fe) | 0.3 |
| Manganese (Mn) | 0.1 |
| Calcium (Ca) | 50 |
| Magnesium (Mg) | 25 |
| Bicarbonate ($HCO_3$) | 250 |
| Sulphate ($SO_4$) | 250 |
| Chloride (Cl) | 250 |
| Nitrate ($NO_3$) as N | 10 |
| Hardness (as $CaCO_3$) | 250 |
| pH, units | 6.5-8.5 |
| Dissolved solids | 750 |
| Silica | 50 |
| Colour, units | 20 |
| Suspended solids | 15 |

* Industries include the manufacture of synthetic rubber, plastics, fertilizers, soap and detergents, organic and inorganic chemicals, etc.
(1) Because of the varying requirements of the many uses in the vast number of chemical industries, more stringent restrictions are placed on several of the above noted characteristics. In some cases, any concentration can be handled, while in others, the raw water is accepted as received provided it meets total solids or other limiting values. The above concentrations are suggested guidelines that should be suitable for the majority of uses in the chemical industry.

### TABLE IWS-3

### WATER QUALITY CRITERIA FOR COOLING WATER*

(Unless otherwise indicated, units are mg/l)

| Characteristic | Concentration |
|---|---|
| Turbidity | 50 |
| Hardness | 50 |
| Iron | 0.5 |
| Manganese | 0.5 |

- Cooling waters should have appropriate initial temperatures and should not deposit scale, be corrosive or encourage the growth of slimes. Among the constituents of natural water that may prove detrimental to its use for cooling purposes are hardness, suspended solids, dissolved gases, acids, oil and other organic compounds and slime-forming organisms.

### TABLE IWS-4

### WATER QUALITY CRITERIA FOR THE FOOD PROCESSING INDUSTRY

(Unless otherwise indicated, units are mg/l)

| Characteristic | Concentration |
|---|---|
| Alkalinity ($CaCO_3$) | 150 |
| pH, units | 6.5-8.5 |
| Hardness ($CaCO_3$) | 150 |
| Chloride (Cl) | 250 |
| Sulphate ($SO_4$) | 250 |
| Iron (Fe) | 0.2 |
| Manganese (Mn) | 0.2 |
| Chlorine (Cl) | (1) |
| Fluoride (F) | 1(2) |
| Silica ($SiO_2$) | 50 |
| Phenol | (3, 4) |
| Nitrate ($NO_3$) as N | 10(2) |
| Nitrite ($NO_2$) as N | (3) |
| Organics: | |
| Carbon chloroform extract (CCE) | 0.15 |
| Odour, threshold number | (3) |
| Taste, threshold number | (3) |
| Turbidity | (6) |
| Colour, units | 5 |
| Dissolved solids | 500 |
| Suspended solids | 10 |
| Coliform, count/100 ml | (6) |
| Total bacteria, count/100 ml | (7) |

(1) Process waters for food canning are purposely chlorinated to a selected, uniform level. An unchlorinated supply must be available for preparation of canning syrups.

(2) Waters used in the processing and formulation of foods for babies should be low in fluorides concentration. Also, because high nitrate intake is alleged to be involved in infant illnesses, the concentration of nitrates in waters used for processing baby foods should be low.

(3) Zero, not detectable by test.

(4) Because chlorination of food processing waters is a desirable and widespread practice, the phenol content of intake waters must be considered. Phenol and chlorine in water can react to form chlorophenol, which even in trace amounts can impart a medicinal off-flavour to foods.

(5) Maximum permissible concentration may be lower depending on type of substance and its effect on odour and taste.

(6) As required by OWRC Drinking Water Objectives.

(7) The total bacterial count must be considered as a quality requirement for waters used in certain food processing operations. Other than aesthetic considerations, high bacterial concentration in waters coming in contact with frozen foods may significantly increase the count per gram for the food. Waters used to cool heat-sterilized cans or jars of food must be low in total count for bacteria to prevent serious spoilage due to aspiration of organisms through container seams. Chlorination is widely practised to assure low bacterial counts on container cooling waters.

## WATER QUALITY CRITERIA FOR THE ELECTROPLATING AND METAL FINISHING INDUSTRIES — IWS-5

Plating-room processes that utilize water include the stripping or pickling operations, cleaning by organic solvents or alkaline solutions, rinsing, and electrochemical plating. For acid stripping or for alkaline cleaning, the quality of water used in the baths is seldom critical, for the added chemicals far outweigh the natural constituents of the water. Hardness of water may be detrimental when soaps or alkaline cleaning agents are used.

For rinsing and for plating, water quality is frequently a major problem. High quality water is of primary importance to assure satisfactory finished work. For decorative plating, water spots and stains may necessitate reworking, wiping, buffing, and other laborious operations. Before the application of any organic corrosion-resistant coating, it is almost a necessity to use demineralized water in the final rinse, in order to achieve adhesion of the coating. A high concentration of dissolved solids is especially detrimental in rinse waters.

In plating baths, iron, aluminum, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulphide, sulphite, sulphate, fluoride, chloride, silicate, copper, and lead have been reported to cause difficulties under certain conditions. Considerable evaporation occurs from plating baths and hence the ions present in the make-up water are concentrated to the extent that they are troublesome.

Calcium and magnesium are especially troublesome in plating baths, for they tend to precipitate to form scale on the heated surface or a sludge in the water. There is a probability of these precipitates being included in the electro-deposit, causing pits, porosity, and roughness. Magnesium may also reduce the "throwing power" in chromium baths, but on the other hand, magnesium sulphate is sometimes added to nickel-plating baths to produce softer deposits, to minimize certain types of pitting, and to increase throwing power.

Sodium and potassium are generally not harmful in plating operations, although sodium may cause brittle deposits in nickel baths or reduce the throwing power in chromium solutions. Iron is one of the most troublesome pollutants of many plating operations. In a nickel-sulphate bath, it may cause hazy, streaked, pitted, or brittle deposits; in acid copper solutions, it produces rough deposits; in chromium baths, it reduces the throwing power; in

cadmium cyanide, it causes hazy deposits; in silver cyanide, stained deposits; and in zinc sulphate baths it lowers the plating efficiency and the protective value of the coating.

Among the anions, bicarbonates are detrimental in heated alkaline baths, for they tend to be converted to carbonates and accelerate the precipitation of calcium. Moreover, they buffer the water and require higher dosages of acid or alkali to obtain the desired pH value. Chlorides have been reported to cause rough, modular, iridescent, and crystalline deposits in cadmium, copper, silver, and tin baths respectively. Organic substances reduce chromium, and cause rough, hazy, streaked, coloured, or pitted deposits under various conditions. Colour and turbidity are similarly objectionable.

Abstracted from "Water Quality Criteria", 2nd Edition, State Water Quality Control Board, California, Publication No. 3-A

**TABLE IWS-6**

**WATER QUALITY CRITERIA FOR THE IRON AND STEEL INDUSTRY**

(Unless otherwise indicated, units are mg/l)

| Characteristic | Quenching, hot rolling, gas cleaning | Cold rolling | Selected rinse waters | |
|---|---|---|---|---|
| | | | Softened | Demineralized |
| Suspended solids | 25 | 10 | (2) | (2) |
| Dissolved solids | (1) | (1) | (1) | (2) |
| Alkalinity ($CaCO_3$) | (3) | (3) | (3) | (2) |
| Hardness ($CaCO_3$) | (3) | (3) | 100 | (2) |
| pH, units | 6.0-9.0 | 6.0-9.0 | 6.0-9.0 | (3) |
| Chloride (Cl) | 150 | 150 | 150 | (2) |
| Dissolved oxygen ($O_2$) | (4) | (4) | (4) | (4) |
| Temperature, °F | 100 | 100 | 100 | 100 |
| Oil | (1) | (2) | (2) | (2) |
| Floating material | (1) | (2) | (2) | (2) |

(1) Accepted as received if meeting total solids or other limiting values.

(2) Zero, not detectable by test.

(3) Controlled by treatment for other constituents.

(4) Minimum to maintain aerobic conditions.

## TABLE IWS-7

## WATER QUALITY CRITERIA FOR THE PETROLEUM INDUSTRY

(Unless otherwise indicated, units are mg/l)

| Characteristic | Concentration |
|---|---|
| Silica ($SiO_2$) | (1) |
| Iron (Fe) | 1 |
| Calcium (Ca) | 75 |
| Magnesium (Mg) | 25 |
| Bicarbonate ($HCO_3$) | (1) |
| Sulphate ($SO_4$) | (1) |
| Chloride (Cl) | 200 |
| Fluoride (F) | (1) |
| Nitrate ($NO_3$) as N | (1) |
| Dissolved solids | 750 |
| Suspended solids | 10 |
| Hardness ($CaCO_3$) | 350 |
| Noncarbonate hardness ($CaCO_3$) | 70 |
| Colour, units | (1) |
| pH, units | 6.0-9.0 |

(1) Accepted as received if meeting total solids or other limiting values.

## TABLE IWS-8

## WATER QUALITY CRITERIA FOR THE PULP AND PAPER INDUSTRY

(Unless otherwise indicated, units are mg/l)

| Characteristic | Mechanical Pulping | Chemical Pulp and Paper | |
|---|---|---|---|
| | | Unbleached | Bleached |
| Silica ($SiO_2$) | (1) | 50 | 50 |
| Aluminum (Al) | (1) | (1) | (1) |
| Iron (Fe) | 0.3 | 1.0 | 0.1 |
| Manganese (Mn) | 0.1 | 0.1 | 0.05 |
| Zinc (Zn) | (1) | (1) | (1) |
| Calcium (Ca) | (1) | 20 | 20 |
| Magnesium (Mg) | (1) | 10 | 10 |
| Sulphate ($SO_4$) | (1) | (1) | (1) |
| Chloride (Cl) | 500 | 200 | 200 |
| Dissolved solids | (1) | (1) | (1) |
| Suspended solids | (1) | 10(2) | 10(2) |
| Hardness ($CaCO_3$) | (1) | 100 | 100 |
| pH, units | 6.0-9.0 | 6.0-9.0 | 6.0-9.0 |
| Colour, units | 30 | 30 | 10 |
| Temperature, °F | (1) | (1) | 95 |

(1) Accepted as received if meeting total solids or other limiting values.

(2) No gritty or colour-producing solids.

## TABLE IWS-9

### WATER QUALITY CRITERIA FOR THE LEATHER TANNING AND FINISHING INDUSTRY

(Unless otherwise indicated, units are mg/l)

| Characteristic | Tanning Processes | General Finishing Processes | Colouring |
|---|---|---|---|
| Alkalinity ($CaCO_3$) | (1) | 130 | 130 |
| pH, units | 6.0-8.0 | 6.0-8.0 | 6.0-8.0 |
| Hardness ($CaCO_3$) | 150 | (2) | (3, 4) |
| Calcium (Ca) | 60 | (2) | (3, 4) |
| Chloride (Cl) | 250 | 250 | (5) |
| Sulphate ($SO_4$) | 250 | 250 | (5) |
| Iron (Fe) | 0.3 | 0.3 | 0.1 |
| Manganese (Mn) | 0.2 | 0.2 | 0.01 |
| Organics: | | | |
| Carbon chloroform extract (CCE) | (5) | 0.2 | (3) |
| Colour, units | 5 | 5 | 5 |
| Coliform bacteria, count/100 ml | (6) | (6) | (5) |
| Turbidity | (3) | (3) | (3) |

(1) Accepted as received if meeting total solids or other limiting values.
(2) Lime softened.
(3) Zero, not detectable by test.
(4) Demineralized or distilled water.
(5) Concentration not known.
(6) OWRC Drinking Water Objectives.

## TABLE IWS-10

### WATER QUALITY CRITERIA FOR THE TEXTILE INDUSTRY

(Unless otherwise indicated, units are mg/l)

| Characteristic | Sizing Suspension | Scouring | Bleaching | Dyeing |
|---|---|---|---|---|
| Iron (Fe) | 0.3 | 0.1 | 0.1 | 0.1 |
| Manganese (Mn) | 0.05 | 0.01 | 0.01 | 0.01 |
| Copper (Cu) | 0.05 | 0.01 | 0.01 | 0.01 |
| Dissolved solids | 100 | 100 | 100 | 100 |
| Suspended solids | 5 | 5 | 5 | 5 |
| Hardness ($CaCO_3$) | 25 | 25 | 25 | 25 |
| pH, units: | | | | |
| Cotton | 6.5-10.0 | 9.0-10.5 | 2.5-10.5 | 7.5-10.0 |
| Synthetics | 6.5-10.0 | 3.0-10.5 | (1) | 6.5-7.5 |
| Wool | 6.5-10.0 | 3.0-5.0 | 2.5-5.0 | 3.5-6.0 |
| Colour, units | 5 | 5 | 5 | 5 |

(1) Not applicable.

## 4 CRITERIA FOR PUBLIC WATER SUPPLIES (PWS)

Criteria are given for public and private supplies from both surface and ground water sources.

Public supplies include water systems operated by municipalities, public utilities, industries, commissions, commercial establishments, etc. where competent operation of the water supply system is provided.

Private supplies include water systems operated by personnel who may not have the necessary technical or mechanical expertise.

### PWS-1 Criteria for Public Surface Water Supplies

Since treatment processes exist which can convert any raw water (with a few minor exceptions) to potable water, it is necessary to define a commonly accepted treatment system which can produce a potable water at a reasonable cost. For the purposes of these criteria, such a system has been defined to consist of coagulation, flocculation, sedimentation and rapid sand filtration; the use of chemicals is restricted by definition to the commonly used coagulants and chlorine for disinfection.

Two types of criteria have been established, namely the Permissible Criteria and the Desirable Criteria (Table PWS-1). Waters meeting both of these criteria are acceptable for treatment by the defined treatment process stated above. Waters meeting the Desirable Criteria provide for a greater margin of safety.

It should be borne in mind that the values given under the Permissible Criteria cannot be considered as maximum single sample values. These criteria should not be exceeded over substantial portions of time. If this should occur, then it will become necessary to determine the cause and initiate corrective action. The frequency and variety of sampling should be based on the findings of a comprehensive pollution survey.

## TABLE PWS-1

## WATER QUALITY CRITERIA FOR PUBLIC SURFACE WATER SUPPLIES

(Unless otherwise indicated, units are mg/l)

| Constituent or Characteristic | Permissible Criteria | Desirable Criteria |
|---|---|---|
| **Physical** | | |
| Colour (platinum-cobalt) | 75 units | < 5 units |
| Odour | Readily removable by defined treatment | Absent |
| Turbidity | — do — | Absent |
| Temperature | 85°F | Pleasant tasting |
| **Inorganic Chemicals** | | |
| Ammonia | 0.5 (as N) | < 0.01 |
| Arsenic* | 0.05 | Absent |
| Barium* | 1.0 | Absent |
| Boron* | 1.0 | Absent |
| Cadmium* | 0.01 | Absent |
| Chloride* | 250 | < 25 |
| Chromium* (hexavalent) | 0.05 | Absent |
| Copper* | 1.0 | Virtually absent |
| Dissolved Oxygen | ≥ 4 (monthly mean)<br>≥ 3 (individual sample) | Near saturation |
| Fluoride* | See footnote (1) | 1.0 |
| Hardness* | Acceptable levels will vary with local hydrogeologic conditions and consumer acceptance. | |
| Iron (filterable) | 0.3 | Virtually absent |
| Lead* | 0.05 | Absent |
| Manganese* (filterable) | 0.05 | Absent |
| Nitrate plus Nitrite* | 10 (as N) | Virtually absent |
| pH range | 6.0 - 8.5 units | Least amount of interference with treatment process |
| Phosphorus* (phosphates) | Not encourage growth of algae or interfere with treatment process | |
| Selenium* | 0.01 | Absent |
| Silver* | 0.05 | Absent |
| Sulphate* | 250 | < 50 |
| Total Dissolved Solids* (filterable residue) | 500 | < 200 |
| Uranyl Ion* | 5 | Absent |
| Zinc* | 5 | Virtually absent |
| **Organic Chemicals**(2) | | |
| Carbon chloroform extract* (CCE) | 0.15 | < 0.04 |
| Cyanide* | 0.20 | Absent |
| Methylene blue active substances* | 0.5 | Virtually absent |
| Oil and grease* | Virtually absent | Absent |

**Table PWS-1 (cont.)**

| Constituent or Characteristic | Permissible Criteria | Desirable Criteria |
|---|---|---|
| Pesticides: | | |
| Aldrin* | 0.017 | — do — |
| Chlordane* | 0.003 | — do — |
| DDT* | 0.042 | — do — |
| Dieldrin* | 0.017 | — do — |
| Endrin* | 0.001 | — do — |
| Heptachlor* | 0.018 | — do — |
| Heptachlor epoxide* | 0.018 | — do — |
| Lindane* | 0.056 | — do — |
| Methoxychlor* | 0.035 | — do — |
| Organic phosphates plus carbamates* | 0.1 | — do — |
| Toxaphene* | 0.005 | — do — |
| Herbicides: | | |
| 2,4-D plus 2,4,5-T, plus 2,4,5-TP* | 0.1 | — do — |
| Phenolic Substances* | Virtually absent | — do — |
| **Radioactivity** | (pc/l) | (pc/l) |
| Gross beta* | 1,000 | < 100 |
| Radium-226* | 3 | < 1 |
| Strontium-90* | 10 | < 2 |
| **Microbiological** (3) | | |
| Coliform organisms (at 35°C) | 5,000/100 ml | < 100/100 ml |
| Fecal coliforms (44.5°C) | 500/100 ml | < 10/100 ml |
| Fecal streptococci (35°C) | 50/100 ml | < 1/100 ml |
| Total Bacteria (20°C) | 100,000/100 ml | < 1,000/100 ml |
| Clostridia (in water) (35°C) | 50/100 ml | 0/100 ml |

* The defined treatment process has little effect on the constituents.

(1)

| Annual Avg. of Max. Daily Air Temp. F. | Recommended Limit for Fluoride mg/l |
|---|---|
| 50.0 to 53.7 | 1.7 |
| 53.8 to 58.3 | 1.5 |
| 58.4 to 63.8 | 1.3 |

(2) Organic chemicals should not be present in concentrations as to cause adverse tastes and odours which cannot be removed by the defined treatment and/or by chlorination only.

(3) A monthly geometric mean of the results of raw water samples collected on a weekly basis (minimum of one sample per week) should be less than the numbers given under the Permissible Criteria column. These figures do not imply a relationship between bacterial groups.

**PWS-2 Criteria for Public Ground Water Supplies**

With the exception of dissolved oxygen, fluorides and microbiological criteria, the water quality criteria for surface water apply to ground water supplies.

For fluorides, hydrogen sulphide and pollution indicator organisms, the following apply to ground water supplies:

| | Permissible Criteria | Desirable Criteria |
|---|---|---|
| | (Unless otherwise indicated, units are mg/l) | |
| Fluoride | 2.4 | 1.0 |
| Hydrogen Sulphide | 0.1 | Absent |
| Pollution Indicator Organisms | Coliform and other pollution indicator organisms should be virtually absent from all ground water supplies. | |

It is considered desirable to provide the maximum of treatment — chlorination — for all ground water supplies. This measure ensures that nuisance organisms which exist in virtually all waters do not get the opportunity to develop a foothold in a water distribution system and thereby create objectionable conditions.

**PWS-3 Criteria for Private Water Supplies**

The raw water available to private supplies such as individual dwellings, cottages, farms, etc., must be of such quality that it can be used in the raw state or be made acceptable for use with a minimum of treatment limited to disinfection, filtration and/or softening. Economic considerations and lack of technical/mechanical expertise will prohibit the use of raw water supplies that require extensive treatment.

Some surface supplies have turbidities, colour and other undesirable constituents in excess of what can be used effectively in home or farm operations. Some ground water supplies (wells and springs) harbour objectionable gases, nuisance bacteria, in addition to having high concentrations of iron and being highly mineralized. The initial approach in establishing a private water supply should be to explore the ground water potential from the aspects of both quality and quantity. In many instances, deficiencies in ground water quality can be offset at a relatively low cost compared to that for surface waters.

Criteria for private water supplies are identical to the surface water criteria for public water supplies, with the exception of fluorides, hydrogen sulphide, physical and microbiological characteristics. For fluorides and hydrogen sulphide, the applicable criteria appear in Section PWS-2.

**Physical Criteria:**

The water supply should be substantially free from substances offensive to sight, taste or smell. Threshold odour values in excess of three units are generally considered objectionable.

Colour in the water supply should not exceed 15 units (platinum-cobalt scale).

Turbidity should be less than five units. Turbidities of up to 20 units may be removed relatively easily by sand or diatomaceous earth filters.

**Microbiological Criteria:**

| Microorganisms | Permissible Criteria: Chlorination only | Permissible Criteria: Chlorination & Filtration | Desirable Criteria: No Treatment |
|---|---|---|---|
| Coliforms (35°C) | 100/100 ml | 400/100 ml | 0/100 ml |
| Fecal Coliforms (44.5°C) | 10/100 ml | 40/100 ml | 0/100 ml |
| Enterococci (35°C) | 1/100 ml | 4/100 ml | 0/100 ml |
| Total Bacteria (20°C) | 1000/100 ml | 4000/100 ml | 10/100 ml |
| Clostridia (in water) (35°C) | 0/100 ml | 4/100 ml | 0/100 ml |

Raw water samples should be collected at least monthly. The Geometric Mean of sample results should not exceed the values given in the table above.

## 5 CRITERIA OF WATER QUALITY FOR AESTHETICS AND RECREATION (A & R)

All surface waters should be capable of supporting life forms of aesthetic value. The positive aesthetic and recreational values of water should be attained through continuous enhancement of water quality. Surface waters should be of such quality as to provide for the enjoyment of recreational activities such as hunting and fishing which are based on the utilization or consumption of fish, waterfowl and other forms of life.

The aesthetic and recreational values of unique or outstanding waters should be recognized and protected by development of appropriate water quality standards for each individual case. To retain or establish unspoiled wilderness values, it may be necessary to control access by mechanized methods of transportation.

General criteria for recreation and aesthetic use and specific criteria for total body contact recreation follow:

### A & R-1 General Criteria for Recreation and Aesthetics

Surface waters should be free of substances attributable to discharge of waste or land drainage which may impair aesthetic or recreational use, as follows:

(1) Materials that will settle to form objectionable deposits.

(2) Floating debris, oil, scum and other matter.

(3) Substances producing objectionable colour, odour, taste or turbidity.

(4) Materials, including radionuclides, in concentrations or combinations which are toxic or which produce undesirable physiological responses in humans, fish and other life and plants.

(5) Substances, including nutrients, and conditions, including temperature, or combinations thereof in a degree or concentration which produces undesirable types or abundance of aquatic life.

### A & R-2 Criteria for Total Body Contact Recreation

Surface waters for total body contact recreational use should be free of substances attributable to discharge of waste or land drainage as follows:

(1) Materials which will cause the pH to change beyond the range 6.5-8.3.

(2) Materials which will obscure visibility in the water. In designated swimming and diving areas, clarity should be such that a Secchi Disc on the bottom is visible from the surface.

(3) Conditions which will cause the water temperature to exceed 85°F.

(4) Microbiological Criteria
Water used for body contact recreational activities should be free from pathogens including any bacteria, fungi or viruses that may produce enteric disorders or eye, ear, nose, throat and skin infections. Where ingestion is probable, recreational waters can be considered impaired when the coliform, fecal coliform, and/or enterococcus geometric mean density exceeds 1000, 100 and/or 20 per 100 ml respectively, in a series of at least ten samples per month, including samples collected during weekend periods.

If these criteria are exceeded, it will become necessary to determine the cause and initiate corrective action.

When evaluating a given area of water for recreational use, the appropriate numbers of samples, and the choice of tests to be performed should be determined by consultation between sampler and analyst, prior to sampling. An effort should be made to increase utilization of the fecal coliform and enterococcus tests since these presently appear to be the more relevant guides to the bacterial quality of bathing waters.

## GLOSSARY OF TERMS

| | | |
|---|---|---|
| Bioassay | — | A controlled laboratory procedure which subjects live aquatic organisms to various environmental stresses. |
| Effluent Requirements | — | Numerical or verbal descriptions of the quality of a waste or drainage effluent at the point of discharge to a receiving water body, land disposal site or waste disposal well. |
| Eutrophication | — | The increase in the nutrient content of the natural waters of a lake or other body of water. |
| Geometric Mean | — | The nth root of the product of n observations. The equation for the geometric mean ($G_x$) can be expressed as: $G_x = \sqrt[n]{X_1 . X_2 . X_3 \ldots\ldots\ldots\ldots X_n}$ or $G_x = \text{antilog}\left(\frac{\log X_1 + \log X_2 + \ldots . \log X_n}{n}\right)$ |
| Land Drainage | — | Water that has drained from the land surface naturally or through man-made drainage systems. |
| Milligrams per Litre (mg/l) | — | A unit of measure expressing the concentration of a substance in a solution. |
| Milligram equivalents per litre (mg. eq/l) | — | A unit indicating the chemical equivalence of ions; derived by dividing the concentration of an ion in milligrams per litre by the combining weight of that ion. Note: combining weight $= \frac{\text{atomic or molecular weight of ion}}{\text{ionic charge}}$ |
| Oligotrophic | — | Waters with a small supply of nutrients and hence a small organic production; usually having abundant dissolved oxygen at all depths. |
| Photosnythetic (adj.) | — | Relating to the process by which the chlorophyl-bearing cells of green plants convert carbon dioxide ($CO_2$) and water ($H_2O$) into sugar ($C_6H_{12}O_6$) and oxygen ($O_2$) in the presence of light. |
| Raw Water | — | Surface or ground water, prior to treatment. |
| Waste | — | Liquid carrying unwanted materials or compounds resulting from human activities or enterprises to a point of discharge. The mixture may or may not have received treatment. |
| Water Quality Criteria | — | Numerical or verbal descriptions of the quality of water required for particular uses. |
| Water Quality Standards | — | Numerical or verbal descriptions of the quality of water required for a variety of uses in a given drainage system. |

## REFERENCES


Bernstein, L. (1967)—Quantitative Assessment of Irrigation Water Quality; Water Quality Criteria, ASTM STP 416, pp. 51-65.

Hem, J. D. (1959)—Study and Interpretation of the Chemical Characteristics of Natural Water; U.S. Geol. Survey, Water-Supply Paper 1473.

Lunin, J. (1967)—Water for Supplemental Irrigation; Water Quality Criteria, ASTM STP 416, pp. 66-78.

McKee, J. E. and Wolf, H. W. (1963)—Water Quality Criteria; California State Water Quality Control Board, Publication No. 3-A.

Federal Water Pollution Control Administration, U.S. Dept. of the Interior (1968)—Report of the Committee on Water Quality Criteria.

U.S. Salinity Laboratory Staff, (1954)—Diagnosis and Improvement of Saline and Alkali Soils; U.S. Department of Agriculture Handbook No. 60.

Wilcox, L. V. and Durum, W. H. (1967)—Quality of Irrigation Water; Irrigation of Agricultural Lands, American Society of Agronomy, No. 11, pp. 104-122.

Wright Rain Ltd. (1956)—Sprinkler Irrigation Manual.